Heating Piping & Air Conditioning

SEPTEMBER 1956

INDUSTRIAL • COMMERCIAL • INSTITUTIONAL • PUBLIC BUILDINGS

Journal Section of the American Society of Heating and Air-Conditioning Engineers—p. 117

Contents ..... page 5

Data Sheet .. page 116

Double duty well water cuts costs of air conditioning pioneer multistory curtain wall office building in Minneapolis 80

How GRINNELL insures the accuracy of its pipe fittings

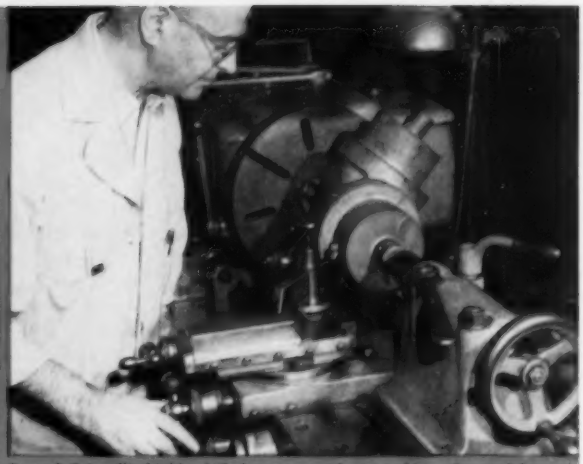
The accuracy and uniformity that is built into Grinnell pipe fittings starts at the pattern shop. Here, pattern makers, highly skilled from many years of experience with Grinnell products, painstakingly machine the pattern models — the first step in producing a top quality fitting.

These craftsmen also make the precision core box to the same exacting tolerances as the pattern. Perfectly matched to each other, the core made from the core box and the mold made from the pattern produce the exceptionally accurate casting.

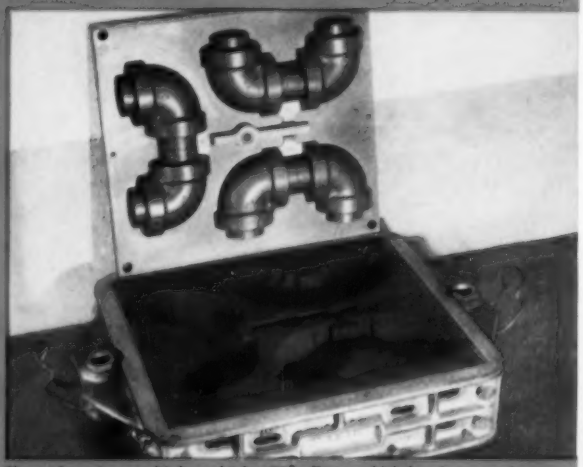
Special machines, designed and custom-built by Grinnell engineers and tool room experts, complete the machining of the Grinnell fitting.

Other outstanding features of Grinnell fittings include: high quality metal; smooth surfaces inside and out; proper chamfer for easy starting and protection of first thread; precision threads for easy running up and tight joints; exact angles; and tested strength. Order a supply from your local Grinnell Distributor.

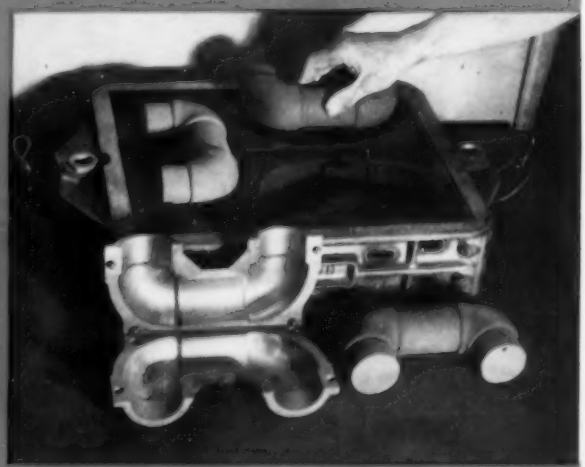
GRINNELL
WHENEVER PIPING IS INVOLVED



One of Grinnell's highly skilled pattern makers machines the model for a 90° elbow.



Shown here is a multiple mold for 90° elbows which has been made from the pattern above it.

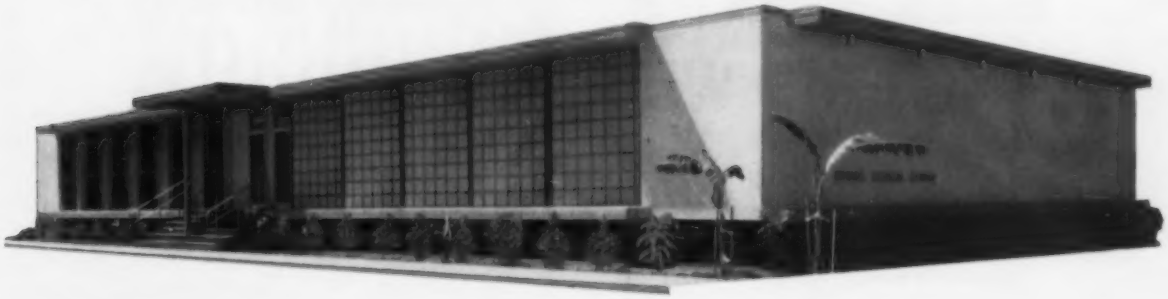


In the foreground is the precision core-box and core made in it. In the background, cores are being placed in the mold.

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports
Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

UNUSUAL HANDLING OF SUPPLY AND RETURN AIR SAVES MONEY FOR TEXAS MEDICAL CENTER



usAIRco

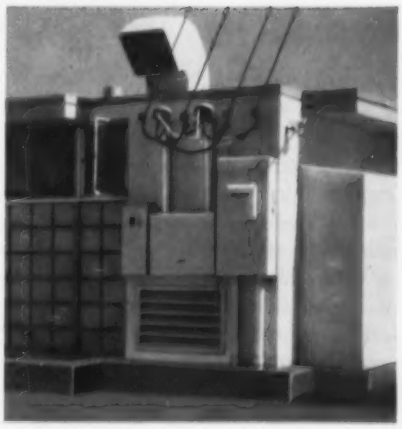
central station RK and duct type gas heaters provide year around conditioning

In addition to eliminating extensive piping runs and lowering labor costs at the new Olmos Medical Center, usAIRco's central station RK requires no roof cooling tower, thus preserving the modern lines of the 48-room San Antonio, Texas structure.

A compact usAIRco RK-25 containing all the elements of a built-up system—air conditioning section, compressor section and water saving evaporative condenser—is located in the indoor equipment room at the rear of the building. Two main supply ducts lead from the equipment room down the center of each double set of offices separated by a center hallway the length of the building. A short take-off from either side of each main duct distributes conditioned air to the individual offices by means of a two-way high wall discharge. The same system furnishes heat in winter, with a usAIRco gas-fired heater in each main supply duct.

Return air grilles are located in each room and in the floor of the hallway, as shown in the top picture at right. A return air plenum extends under the entire floor area of the building. Lower picture of rear of building shows how air is returned to the RK through a chase. The goose-neck exhaust and louvered grille fresh air intake seen in this picture, serve the evaporative condenser.

The Olmos Medical Center was designed by Cerf Ross Associates, architects. The air conditioning system was engineered by Martin E. Staley and installed by the C. H. Dillard Company.



For RK literature write G. Robert McLain

UNITED STATES AIR CONDITIONING CORPORATION

7900 Tabor Road, Philadelphia 11, Pennsylvania
Export: 13 E. 40th St., N. Y. 16, N. Y., U.S.A.

usAIRco
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BUSH

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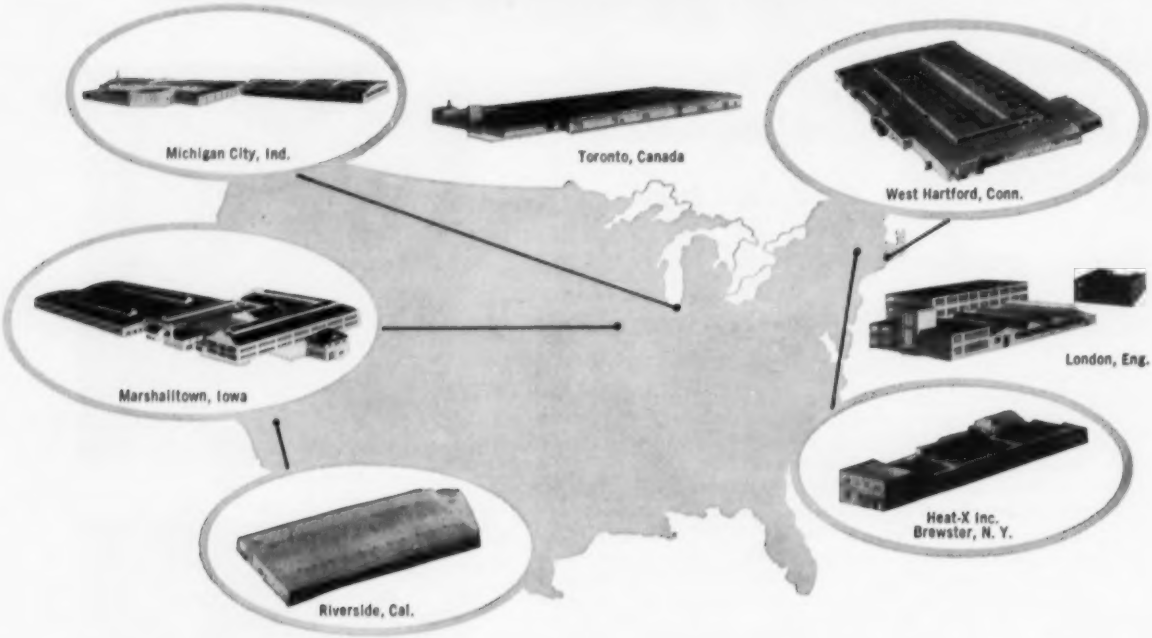

Heating, air conditioning and refrigeration products are flowing from the recently formed Dunham-Bush manufacturing facilities.

This "one-source" teaming of Dunham and Bush spells many advantages for architects, engineers, wholesalers and contractors.

A nationwide network of manufacturing plants and strategically located warehouses assures the "close-to-source" supply that permits faster delivery, lower freight costs. A substantially expanded force of sales engineers makes available on-the-spot engineering and application assistance. Greatly augmented resources and facilities permit continued research and development of new products to serve an expanding field.

Dunham-Bush . . . *a single source, single responsibility* for heating, air conditioning and refrigeration . . . teamed to serve an industry's growing needs.

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AIR CONDITIONING, REFRIGERATION, HEATING PRODUCTS AND ACCESSORIES

Heating Piping & Air Conditioning

Vol. 28 No. 9

SEPTEMBER 1956

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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Features

Electricity Heats Viscous Fluids in Diverse Piping Systems ____ 75
Lee P. Hynes

Sam Lewis' Page ____ 79
Analyze heat transfer problems in converter tube design

Double Duty Well Water Cuts Cooling Costs in Office Building ____ 80
John E. Starrett

How, When, and Where to Use Air Cooled Condensers ____ 84
Warren Viessman

Use "Shell Coefficient" to Compare Thermal Ratings of Buildings ____ 88
Willie Hammer

How Automation Cuts Costs of Air Conditioning Buildings ____ 92
. . . with master data and control centers

How the Main Piping Was Designed for Gallatin Steam Plant ____ 96
Roy E. Lyon

Night Air Cooling Cuts Refrigeration for Air Conditioning ____ 100
John Kline

Consumable Solid Insert Rings Improve Pipe Welding Quality ____ 105
Helmut Thielsch

On the Job ____ 108
53 F well water serves package units in shopping center

Engineer Shortage Hampers Industrial Ventilation Progress ____ 109
K. E. Robinson

The Law and Your Profits ____ 111
Insist on written commitments

Question of the Month ____ 114
What's causing compressors to fail?

Data Sheet ____ 116
Controlling air conditioning maintenance

ASHAE Journal Section

Analysis of an Air-Conditioning Thermal Circuit ____ 117
G. V. Parmelee, P. Vance and A. N. Cerny

President's Page — Our 63rd Chapter ____ 124
John W. James

Relation of Lighting to the Cooling Load ____ 125
Report of Joint IES-ASHAE Committee

Abstracts from a Symposium on Residential Air Conditioning ____ 132

All Paths Lead to Chicago for Society's 63rd Annual Meeting ____ 140

Thermal Circuits ____ 142
S. F. Gilman

Activities of Society Chapters ____ 143

Candidates for Membership ____ 144

Officers, Council and Committees ____ 146

Departments

The Editors' Page ____ 65

"Open for Discussion" ____ 69

Equipment Developments ____ 183

Recent Trade Literature ____ 236

Who's What ____ 268

We Hear That ____ 288

Meetings and Conventions ____ 298

New Books and Reports ____ 310

Index to Advertisers ____ 316

How to Get More Work Out of Steam Heated Equipment

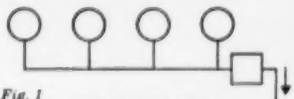


Fig. 1

WRONG WAY
"GROUP TRAPPING"

• One trap drains a group of steam condensing units. This causes "short-circuiting," entrainment of air, low and erratic temperatures. Ask for Bulletin 825 for complete details.

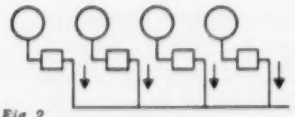


Fig. 2

RIGHT WAY
"UNIT TRAPPING"

• One trap drains *each* steam condensing unit. Condensate *and air* are removed as fast as they accumulate. This assures top temperatures and peak performance all the time.

Example: Armstrong "Unit Trapping" Increases Wood Core Press Production 20%

If, anywhere in your plant, you have more than one steam heated machine—or coil, chest or roll of a machine—being drained by a single steam trap, give a listen to this:

Mr. Dominic Reali, plant engineer at the Stanley Company, Stanley, Wisconsin, was faced with glue joint failures on wood veneer coming off a platen press. The press was group trapped (Fig. 1) when he took over. Platen temperatures were erratic and production was inadequate.

What did Mr. Reali do? He called an Armstrong Representative to help him select a trap for *each* platen of the press. (Fig. 2)

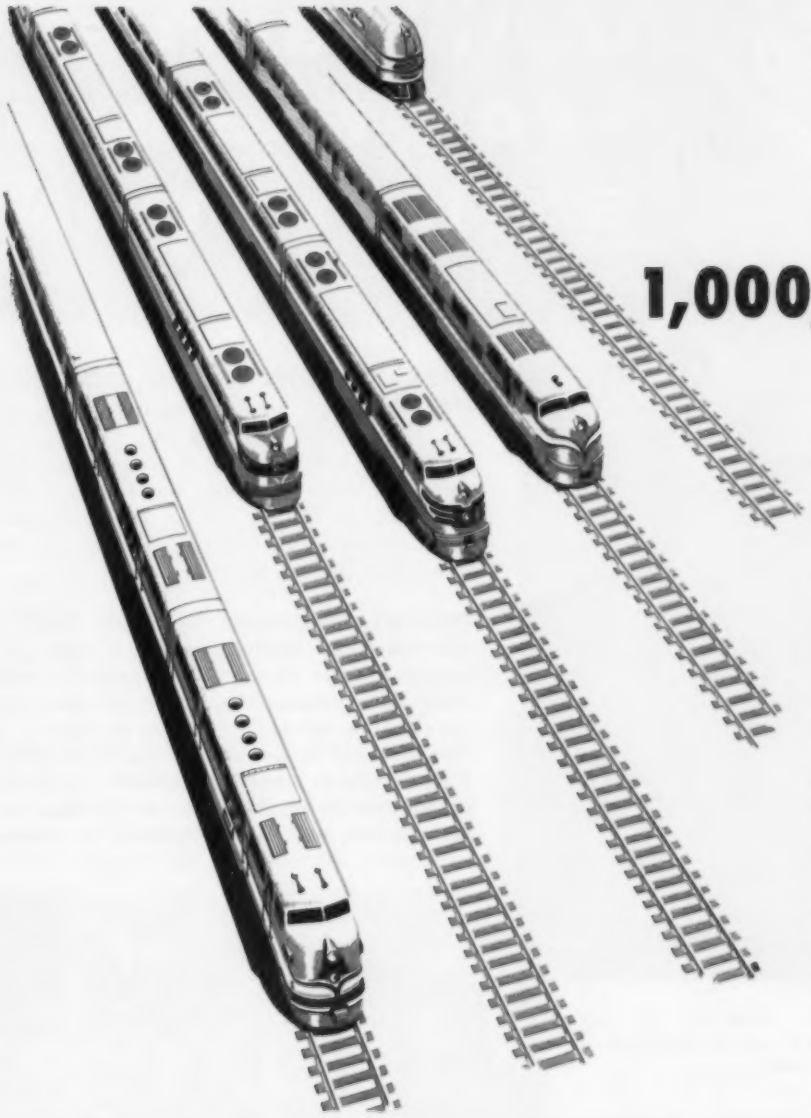
Now, press production is up 20% and glue joint failures are just a memory.

It doesn't matter whether you operate platen presses, jacketed kettles, unit heaters or what, the principle is the same. Armstrong *unit trapping* always makes equipment perform better.

GET COMPLETE DETAILS . . . Armstrong Bulletin No. 825, "Preventing Short Circuiting of Steam" tells the how and why of "group trapping" versus "unit trapping," explains what happens in steam condensing units. Free on request to your local Armstrong Representative, or:

ARMSTRONG MACHINE WORKS
874 Maple Street • Three Rivers, Michigan

ARMSTRONG STEAM TRAPS



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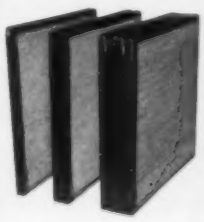
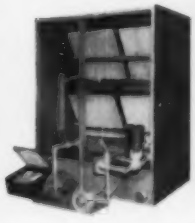
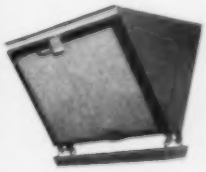
If you, too, look for reasonable first cost, low maintenance cost and high efficiency regardless of conditions, type of job or geographic location, you can depend on FAR-AIR. Write for complete catalog to FARR COMPANY, P. O. Box 45187, Airport Station, Los Angeles 45, California.



Heart of the FAR-AIR line is the 1", 2" and 4" thick filters. Available in all sizes and most metals.



Another FAR-AIR first. A completely automatic filter that washes and re-oils itself. Sizes to meet any CFM requirement.



A complete line of grease eliminators, easy to clean, safe to use, low in cost.

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CHOICE OF MODEL FOR BEST AND EASIEST INSTALLATION — Lowboys for overhead mounting, Highboys for floor and wall installation — models for low headroom — all compact, self-contained units. Highboys and Lowboys have the exclusive "Buffalo" 90° or 45° Swivel Outlets for directing air flow accurately, or for duct connection. Adjustable V-belt drive.

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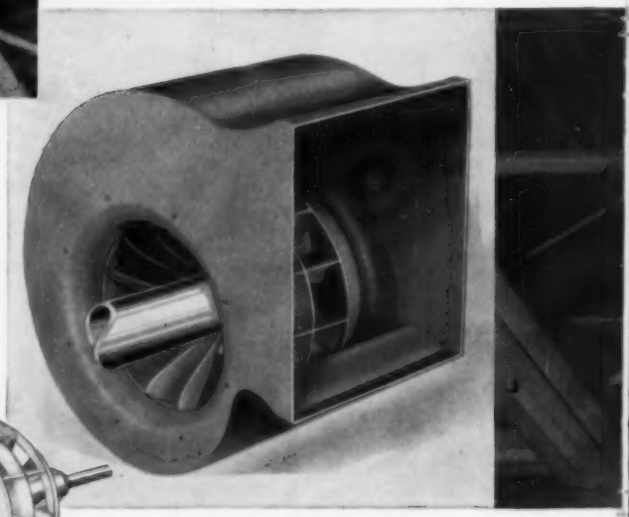

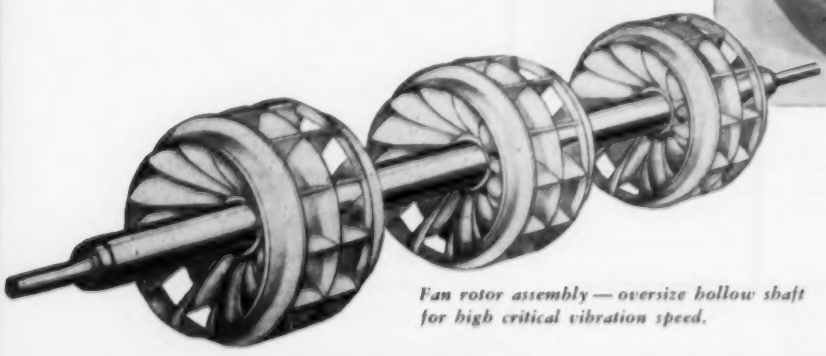

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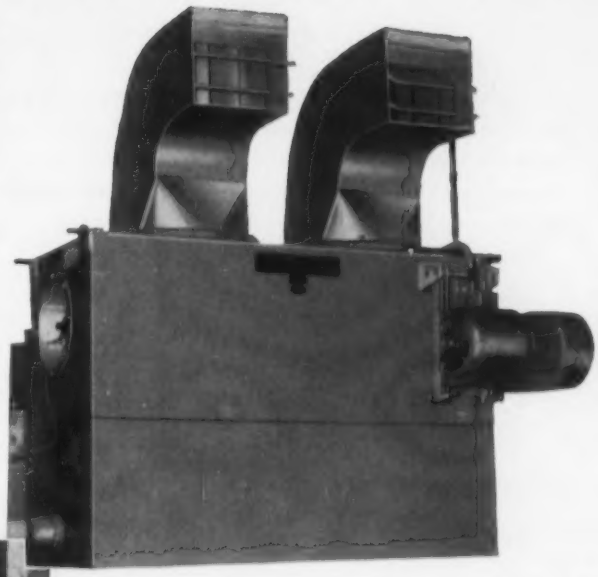

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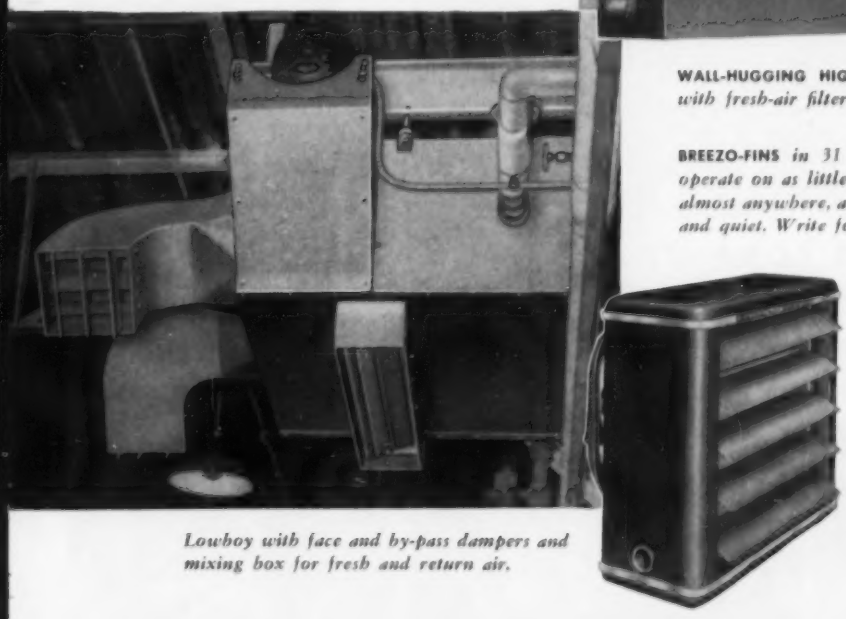

Lowboy with face and by-pass dampers and mixing box for fresh and return air.

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thermostatic control system

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MIDWEST SHEET METAL WORKS
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Piping Contractors

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65 Years of Automatic Temperature and Humidity Control

POWERS CONTROL

Symbol of Economy and Quality Control

(c79)

Efficiency combined with architectural beauty is the keynote in this colorful building. It has a curtain wall of blue-green porcelain enameled steel; an auditorium seating 266 people; the Martin Luther Library; sunken garden terrace and fresh air intake louvers above, which are well integrated into the building design. Photo below shows zone temperature indicator also the central control panel of the POWERS AIR CONDITIONING CONTROL SYSTEM.

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Easily, Quickly Set Up—Built-in folding tray and legs open up for business instantly—all one unit, no loose parts.

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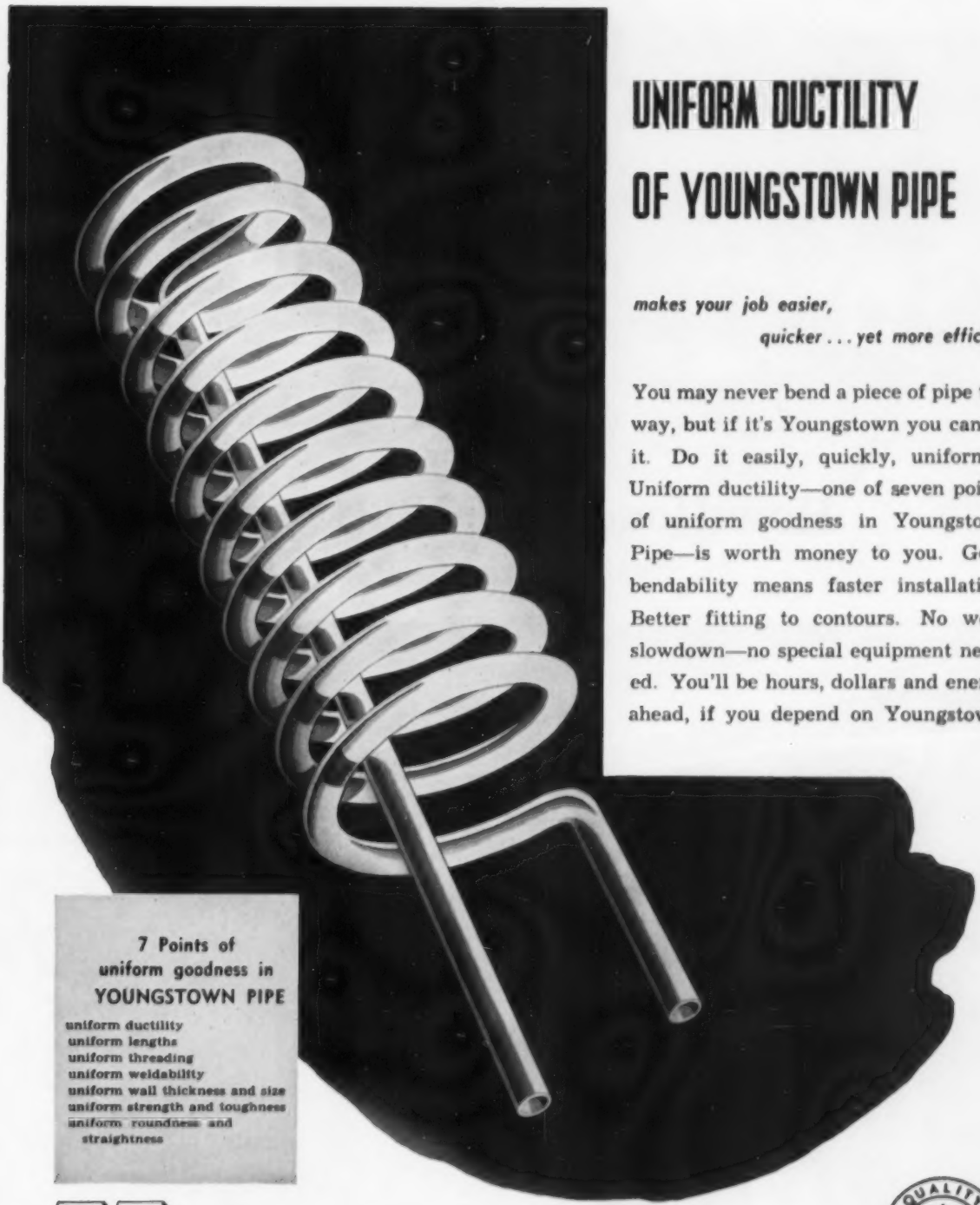

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makes your job easier,
quicker . . . yet more efficient

You may never bend a piece of pipe this way, but if it's Youngstown you can do it. Do it easily, quickly, uniformly. Uniform ductility—one of seven points of uniform goodness in Youngstown Pipe—is worth money to you. Good bendability means faster installation. Better fitting to contours. No work slowdown—no special equipment needed. You'll be hours, dollars and energy ahead, if you depend on Youngstown.

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- uniform weldability
- uniform wall thickness and size
- uniform strength and toughness
- uniform roundness and straightness

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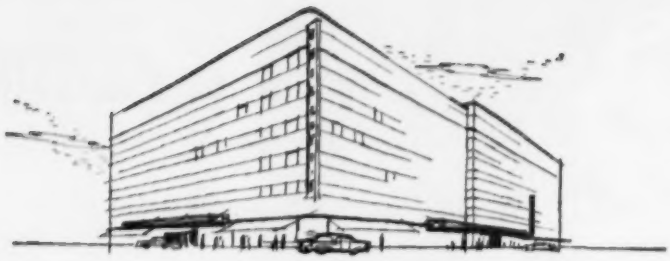


Comfort story of a modern department store

How Honeywell Electronics makes

Shillito's Department Store, Cincinnati, O., a Federated Department Store.
Engineer: Leo S. Weil & Walter B. Moses, New Orleans, La., and St. Louis, Mo. Architect: Potter, Tyler, Martin & Roth, Cincinnati.

Typical shopping areas in Shillito's illustrate need for accurate control of large open spaces—maintained ideally by Honeywell Electronic Temperature Control. Other major advantages of the installation are:

. . . ***central control***—one operator at the Honeywell Supervisory DataCenter can read and adjust temperature at 36 locations throughout the store.

. . . ***savings on cooling***—outside air is used to help cut costs of refrigeration.

. . . ***savings on maintenance***—with central electronic control, fewer men are needed to maintain all mechanical equipment.

. . . ***quick response*** of electronic control system keeps indoor climate ideal regardless of changes in customer occupany.

central air conditioning pay off

Honeywell Supervisory DataCenter provides central control of modernized air conditioning system in seven-story building

A MODEL of centrally air conditioned comfort—that's Shillito's Department Store, southern Ohio's largest.

It's a model of air conditioning convenience and economy, too—thanks to Honeywell Electronic Temperature Control, chosen to govern the Cincinnati store's recently installed central heating and cooling system.

Air conditioning units scattered throughout the store had caused discomfort and maintenance headaches. Shillito's management wanted a new central system—and *central control* of the system. Honeywell Electronics provides it.

One man now can control the entire system from the Honeywell Supervisory DataCenter. At this single point he can adjust 38 thermostats and check temperatures at 76 different locations divided among the store's seven floors.

The result is better shopping climate for customers; better supervision of the air conditioning system that saves money for management—on fuel, power and maintenance.

Honeywell Electronic Temperature Control offers many unique advantages in air conditioning management. It can serve your clients well in any building, new or existing, by providing new efficiency and economy in heating, ventilating, air conditioning and industrial control.

Call your Honeywell office for the new booklet that tells more fully how to apply electronics to your clients' problems—and for information on the economical Honeywell Periodic Maintenance Plan. Or write Honeywell, Dept. HA-9-102, Minneapolis 8, Minn.

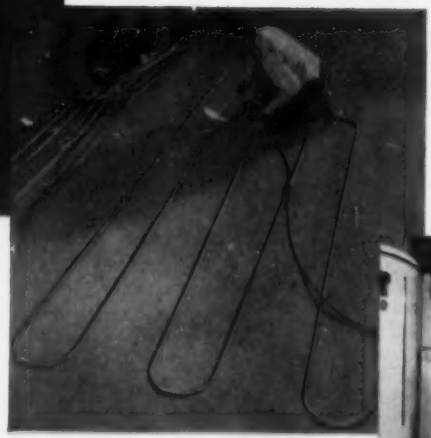
MINNEAPOLIS **Honeywell**

112 offices across the nation

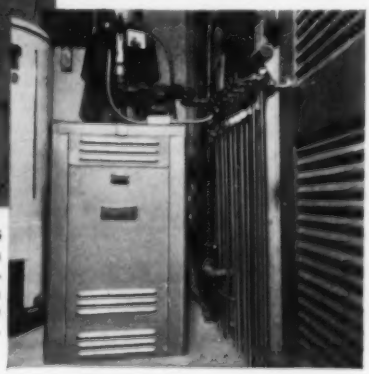
Electronic Controls

SUPERIMPOSED on the photograph of the living room, in one of the homes of the Crabapple Court tract, is a section of the radiant panel heating system. With radiant panel heating picture windows can be brought right to the floor line, allowing a free rein in interior decor and furniture arrangement. And with radiant heat there are no drafts, no hot and cold zones.

CONTRACTOR FOR THE CRABAPPLE COURT tract is the THERMAL ENGINEERING COMPANY of St. Louis. Here you see MR. L. L. VOLLMAN, Vice President of THERMAL, checking the bending of Revere Copper Water Tube in the shop. Tube was procured through the GRINNELL COMPANY of St. Louis.

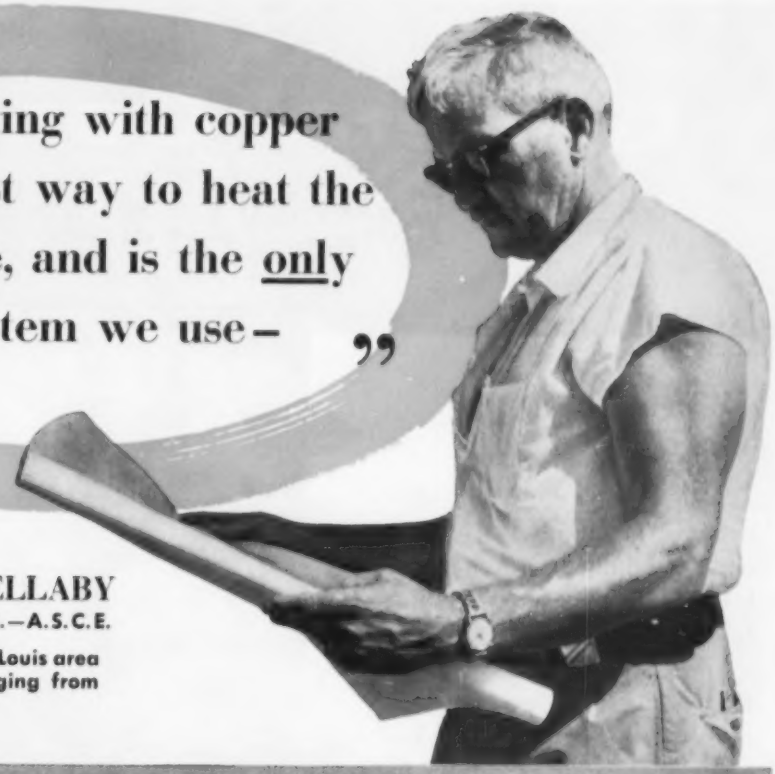


ONE OF THE MANY DESIRABLE FEATURES of enduring Revere Copper Water Tube is that it can be prefabricated in the shop, requires fewer fittings, which when properly brazed or soldered assure tight, nonleaking joints. Completed, prefabricated panels are then shipped to the job and installed, using separate circuits for each room.



BY BRINGING EACH HEATING PANEL individually to a common header, as shown in the boiler hookup, and equipping each with its own valve, heat is easily and accurately regulated to suit individual room requirements.

"Radiant heating with copper tube is the best way to heat the modern home, and is the only heating system we use—"



Says CHARLES H. ELLABY
F.R.S.A.—A.S.C.E.

Builder of 152 homes in the St. Louis area during the past 6 years, ranging from $9,500 to $30,000.

"There are five main reasons why we use copper tube in our radiant heating systems," continued Mr. Ellaby. "First—copper tube doesn't rust, rot or deteriorate, so we have no worry on that score. Second—a radiant system with copper tube is competitive in cost with other top quality heating systems for multiple home building. Third—copper tube is easier to work with . . . requires fewer fittings . . . can be prefabricated in the shop. Fourth—copper tube enables us to guarantee the home owner a trouble-free job. Fifth—copper tube, because of its proved, superb performance in radiant heating and hot and cold water lines, has unquestionable acceptance among prospective home owners . . . in many cases helps sell our homes."

Take a tip from this successful builder of quality homes; don't take chances, use Revere Copper Water Tube not only for radiant panel heating, but for hot and cold water lines, air conditioning lines, waste lines, vent stacks, and underground service lines.

So, when you write your next set of "specs" remember: there is no "or equal" for copper water tube. Keep out of trouble by using Revere Copper Water Tube.

And if you would like aid in the various methods of installing Revere Copper Water Tube, our Technical Advisory Service will be glad to help.

FREE!—For group showing—instructive 16 mm motion pictures in sound and full color. "THE ABC OF RADIANT PANEL HEATING" and "THE RURAL WATER SYSTEM." Write Advertising Dept., for details.

A FEW OF THE 37 HOMES on the Bon-Price tract built by CHARLES H. ELLABY. Price range from $20,000 to $30,000. Homes have summer air conditioning with a central system, using ducts in the ceiling.

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REVERE COPPER AND BRASS INCORPORATED
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Sales Offices in Principal Cities, Distributors Everywhere.

General Controls...

Yesterday's boilers get a new lease

"That's exactly right! With hundreds of paying guests to keep comfortable all winter in our hotel, these veteran boilers looked like they were due to retire. But they're right back on the job today—as good as new, or better. You'd think they had been in a couple of months instead of twenty years. And all it took was reworking the burners and adding a General Controls temperature-controlled proportioning gas valve. I'm sold solid on this B-55G valve. Who wouldn't be?"

MR. John Macdonald
CHIEF ENGINEER

Your gas boiler problems can be solved just as economically, *if* you make the job all General Controls. They put new life in veterans, make new boilers better yet—

AUTOMATICALLY!

HERE'S WHY: General Controls' B-55G provides accurate, dependable, on-off control. Holds steadier steam pressure. Saves fuel with continuous firing advantages. Electrical pilot overrides proportioning control in case of excess pressure, temperature, low water, safety pilot or time control.

puts new life in old timers!

when you install today's finest controls!

✓ **Check your particular gas boiler problem and read off the solution:**

1 ☐ Humless, fail-safe, on-off combustion control valve.

2 ☐ On-off, high-low, and proportioning control.

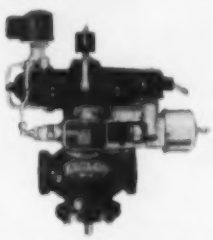
3 ☐ Motor operated shutoff valve, with selected opening/closing speeds.

4 ☐ Mainline, electromagnetic manual reset safety valve.

5 ☐ Heavy-duty solenoid oil shutoff valve.

6 ☐ High capacity, soft-seated gas pilot line shutoff valve.

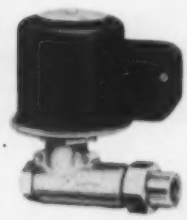
1. B-9SE On-Off Gas Valve – Fast closing, slow opening adjustable to installation requirements. Humless. 3-way pilot. Fail-safe. Air damper control.



2. B-5SG Proportioning Gas Valve – On-off with high-low or proportioning control and air damper control. Adjustable slow opening for varying conditions.

3. H-2 Hydramotor Valve – For motor operated, spring-closed, on-off control with tight shutoff. Available for selected fast or slow opening, and fast (½-2 second) closing. Damper arm control optional.

4. V-110 Electromagnetic Manual Reset Valve – Manual opening with visual position indicator. Open position retained until valve is deenergized, then trip mechanism closes.



5. K-10 Magnetic Lever Valve – Opens against high pressure without dependence on impact action. Solenoid operated, lever acting, packless oil shutoff valve. Fail-safe. For #2-#6 oil.

6. K-3A Pilot Line Solenoid – For all gases. Give positive shutoff with gas pressure on top of seat. High capacity, humless, fail-safe on current failure.

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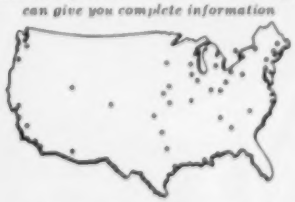
One Reliable Source
For All Boiler Controls and Valves

Your nearby General Controls Branch Office can give you complete information



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FORTY BRANCH OFFICES SERVING THE UNITED STATES AND CANADA

A new CARRIER Centrifugal for air conditioning

From Carrier—the people who built the first centrifugal refrigerating machine—now comes a new centrifugal designed for big-building air conditioning and for chilling water for industries.

It's a hermetic—WITH CARRENE-COOLED MOTOR . . . exclusive with Carrier! Cool, dry refrigerant gas from the refrigerating circuit keeps motor temperatures at a uniform level under all load conditions.

It's a hermetic—WITH ELECTRONIC CONTROLS . . . exclusive with Carrier! You push a single button and electronic controls start, regulate and protect the machine automatically.

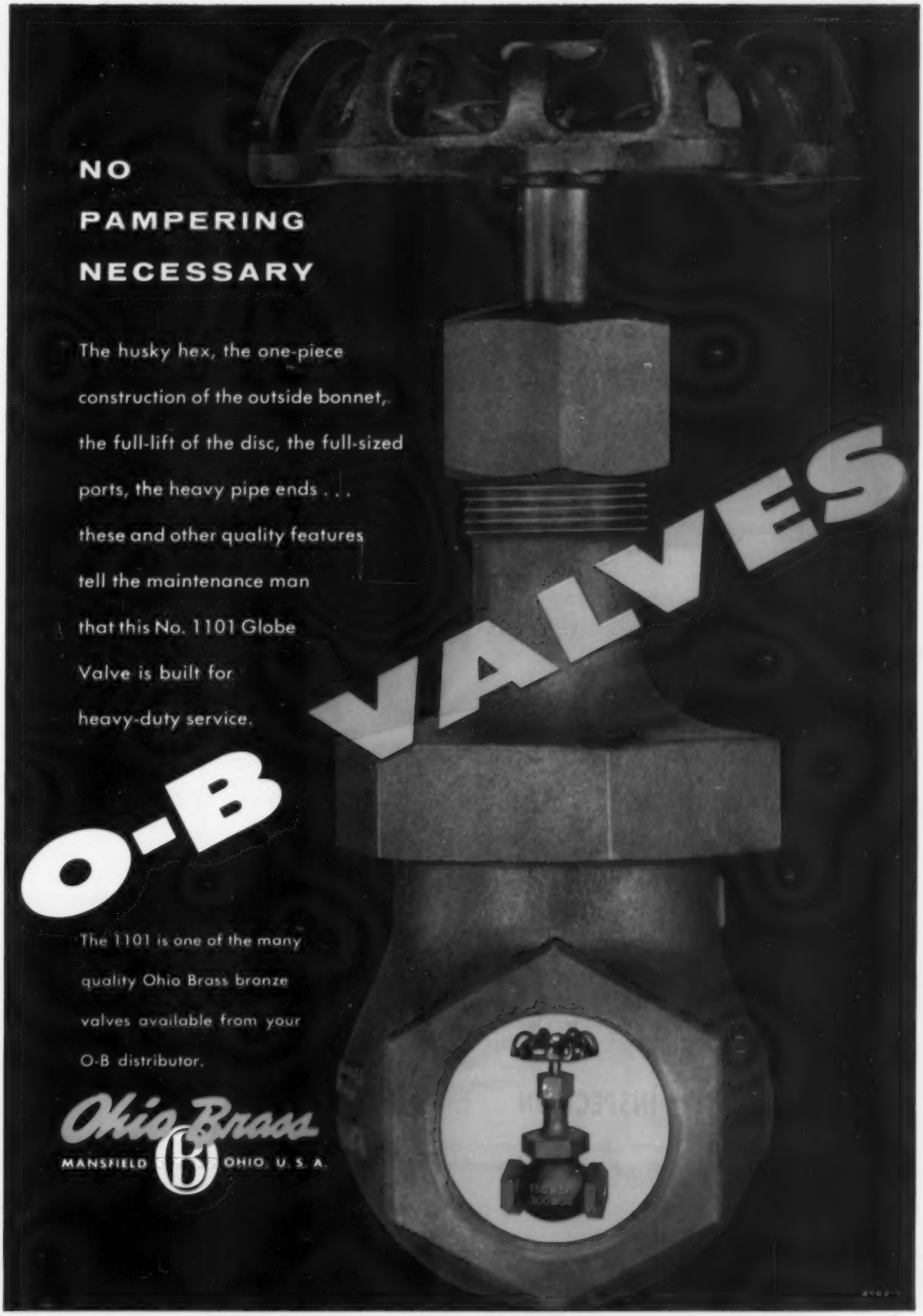
It's a hermetic—WITH CENTRAL CONTROL CONSOLE . . . exclusive with Carrier! All control functions are co-ordinated in a central console. You can locate this nerve center right by the machine, or in the next room.

It's a hermetic—WITH HYDRAULIC CAPACITY VANES . . . exclusive with Carrier! Capacity-regulating prewhirl vanes are positively positioned by hydraulic power under the automatic control of the electronic system.

Telephone the nearest Carrier office for your copy of the big new factual booklet on Carrier Hermetic Centrifugal Refrigerating Machines. Or write Carrier Corporation, Syracuse, New York.

Carrier

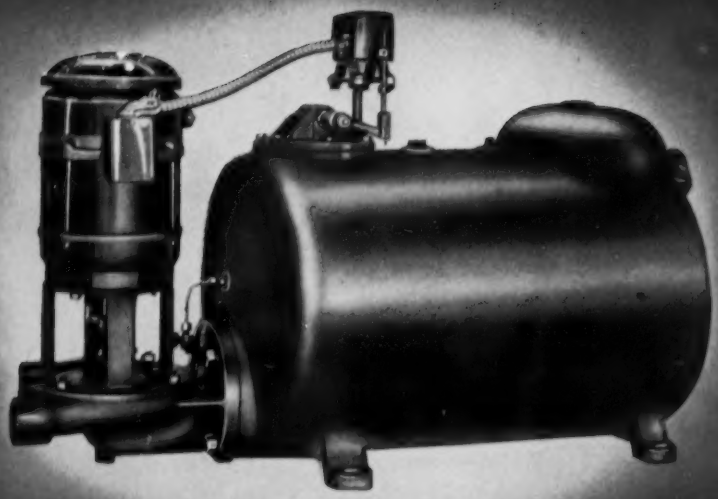
air conditioning • refrigeration • industrial heating


NO
PAMPERING
NECESSARY
The husky hex, the one-piece construction of the outside bonnet, the full-lift of the disc, the full-sized ports, the heavy pipe ends . . . these and other quality features tell the maintenance man that this No. 1101 Globe Valve is built for heavy-duty service.
O-B VALVES
The 1101 is one of the many quality Ohio Brass bronze valves available from your O-B distributor.
Ohio Brass
MANSFIELD OHIO U. S. A.

SKIDMORE PUMPS

set the pace in performance *

TYPE VC PUMP



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*SKIDMORE PUMPS HAVE SET A STANDARD FOR PERFORMANCE AND DEPENDABILITY SINCE 1921.

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Bulletin No. 19-A

TYPE HS
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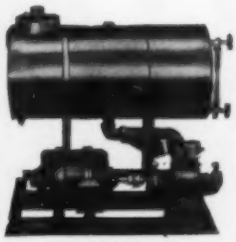


TYPE TM
Bulletin No. 17

QUIET OPERATION

Further evidence of Skidmore's top quality engineering and knowledge of sound design is its quiet operation endowed in every Skidmore Pump.

LOW INLET CONNECTION

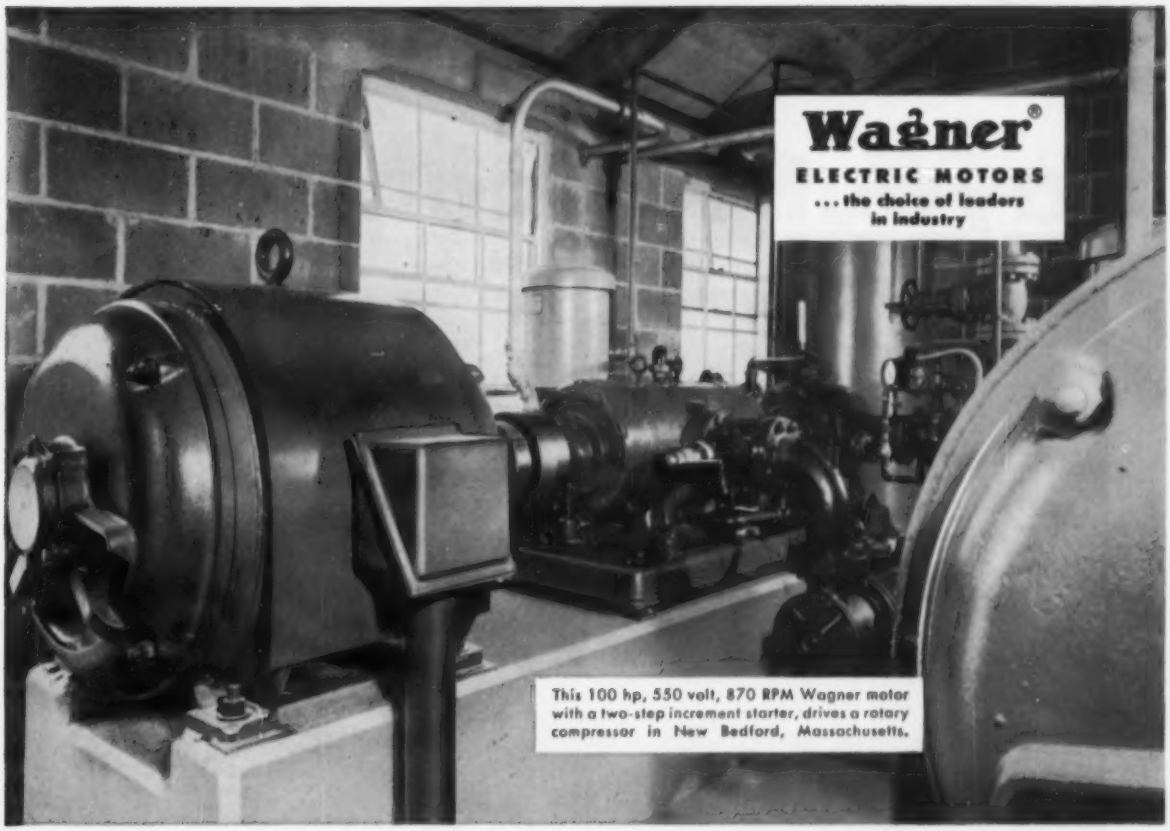
Suited to its specified capacities and pressures for efficient operation in every case—pump is provided with low inlet connection to render additional service and reduce installation costs for low floor returns.

ACCESSIBILITY FOR INSPECTION

Like all Skidmore Pumps the VC unit is built for dependability and freedom from troubles—is readily accessible for inspection or service without disturbing pipe connections.

Call your nearest Skidmore Pump Representative or — write for bulletins

SKIDMORE CORPORATION • ST. JOSEPH, MICHIGAN



This 100 hp, 550 volt, 870 RPM Wagner motor with a two-step increment starter, drives a rotary compressor in New Bedford, Massachusetts.

Start large polyphase motors with minimum line voltage disturbance

USE THE Wagner INCREMENT MOTOR AND STARTER COMBINATION

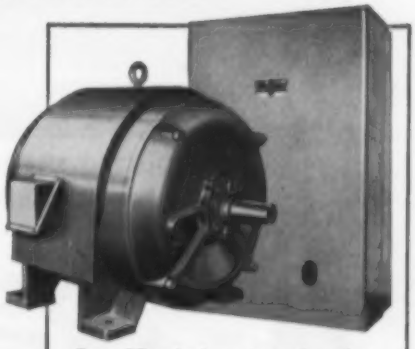
Here's a modern, economical, highly efficient way to start large polyphase motors – the Wagner Increment Motor and Starter "Package."

By reducing current drawn from the line on each point of the starter, the combination limits the inrush of motor current to values that are acceptable for the distribution systems of most power companies.

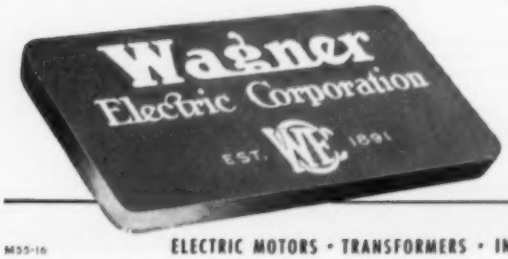
Voltage disturbances on the line are reduced because current taken from the line is not broken during the starting period—as it is when auto-transformers or compensator type starters are used.

Wagner two-step increment motor and starter combinations are suitable for most applications. For installations where unusually low inrush of starting current is desired, Wagner can furnish three-step and four-step increment starters.

Your nearby Wagner engineer will help you select the increment motor and starter combination that meets *your* requirement. Call the nearest of our 32 branch offices, or write us.



Type RP polyphase motor in ratings to 400 hp with increment type starter



Wagner Electric Corporation
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

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ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS-AIR AND HYDRAULIC

AIRCOUSTAT* sound traps layout for controlling

AIRCOUSTAT SILENCES ALL FREQUENCIES IN THE AUDIO-FREQUENCY RANGE
Resonators hold low-frequency sounds
Periodic internal structure dampens middle-frequency noise
Sound-absorbent materials suppress high frequencies

simplify design and air conditioning noise

THIS 5-FT. AIRCOUSTAT REPLACES 80 FEET OF ORDINARY DUCT LINING

AIRCOUSTAT saves you time on the job because it's pre-engineered . . . and fits acoustically if it fits geometrically. AIRCOUSTAT is quick and easy to install . . . no special tools are required.

Most Efficient Solution

AIRCOUSTAT's power to deaden sound is unmatched by other sound control methods devised for air conditioning systems. Acoustical performance is *guaranteed*. Efficiency is more than 13 times that of ordinary lining. And AIRCOUSTAT provides a lower flow resistance and less pressure drop than other sound control methods.

AIRCOUSTAT suppresses sound in low-velocity air conditioning systems . . . will silence an entire system or selected outlets. AIRCOUSTAT units fit any size of duct within the range of unit sizes . . . adapt themselves to any shape of duct.

Cost You 50% Less

AIRCOUSTAT units cost you as much as 50% less than ordinary duct lining . . . with savings in time and labor costs. AIRCOUSTAT is quick and easy to install . . . no special tools are required. You can ship ducts nested together and store them outside on the job site.

Apply Anywhere

AIRCOUSTAT eliminates noise in a wide range of applications: general and private offices, conference rooms, sleeping quarters, and recording studios.

Born of the Jet Age

Koppers' amazing new AIRCOUSTAT is the product of years of experience in designing sound control installations for aviation and other industries. Jet engine housings, machine enclosures, sound barriers and traps, sound-proof foremen's offices—these are only a few of the many sound control devices created by Koppers Industrial Sound Control engineers. Koppers has put this engineering "know-how" to work silencing air conditioning noises more effectively . . . more economically than was ever before possible . . . saving you time and costs.

For more details, write to KOPPERS COMPANY, INC., Industrial Sound Control Dept., 6209 Scott Street, Baltimore 3, Maryland.

*Koppers Trademark

KOPPERS

INDUSTRIAL SOUND CONTROL

Engineered Products Sold with *Service*

Highly flexible, Armaflex follows contours of piping or tubing without any special cutting or fitting. If lines are in operation, slit Armaflex lengthwise, snap in place, and seal with Armstrong 520 Adhesive.

Residential as well as commercial air-conditioning and heating systems perform more efficiently when insulated with Armstrong Armaflex. It goes on fast, makes a neat, clean job.

New insulation for liquid cooling and heating lines

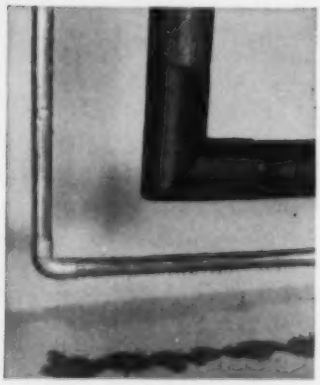
goes on in one fast operation

Armstrong Armaflex® is a new kind of foamed plastic insulation for both commercial and residential air-conditioning and heating lines. Remarkably flexible, it slips right over pipes and copper tubing, follows contours without special cutting or fitting. If lines are already in operation, you can slit Armaflex lengthwise, snap in place, and seal with Armstrong 520 Adhesive. Armaflex is clean to work with, too; it will not rub off, chip, or crumble. Waste is negligible.

A highly efficient material, Armaflex has a K-factor of 0.28 at 75° F. In ½" thickness, Armaflex will prevent condensation under normal design conditions on indoor lines operating as low as 32° F. The insulation's closed cellular structure is exceptionally moisture resistant, eliminates the need for a separate vapor barrier. A self-extinguishing feature makes Armaflex completely safe to install before sweat fittings are made.

Armaflex comes in 6′ lengths for copper tubing and iron pipe ⅜" to 3⅛" O.D. Thicknesses of ½" and ⅜" are available.

For free booklet containing complete data on this remarkable new insulation, write to Armstrong Cork Company, 2009 Sherman St., Lancaster, Pa.



Condensation is prevented by Armaflex's vaporproof composition. Countless, uniformly sized cells seal out moisture and air, give Armaflex its low K-factor of 0.28 at 75° F. mean temperature.

Rapid fabrication of fitting covers is accomplished by miter-cutting pieces of Armstrong Armaflex, cementing them together with Armstrong 520 Adhesive to form a vaporproof joint.

Armstrong
INDUSTRIAL INSULATIONS

But it takes more than a sign to stop low water . . .

. . . and the hazards that can accompany a low water condition in both a steam and hot water heating boiler.

We are all agreed that our schools must be made as safe as possible. With schools so crowded today and facilities overtaxed, there is greater need for vigilance than ever before.

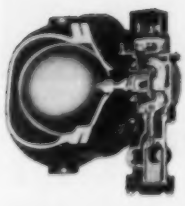
One thing you can do is to see that the boiler water line is under the endless vigil of McDonnell boiler water level controls. Low water can strike anywhere, for any of a score or more reasons, bringing with it the threat of serious and costly damage. And make no mistake about this: Low water is just as much of a possibility in hot water boilers as in steam boilers.

For the average school heating boiler, McDonnell Feeder Cut-off Combinations are a simple, time-proved answer. They add water automatically when needed to maintain a safe water level in the boiler, then stand by to stop the burner if any emergency condition drops the water line to a dangerous level. There is nothing better available for the vital task of protecting a boiler against hazardous low water.

Right now is the time to act. Your local school board must rely on you to bring it to their attention. You'll be doing your community even a bigger favor than you do yourself.

McDONNELL & MILLER, *Inc.*, 3500 N. Spaulding Ave., Chicago 18, Ill.

Doing One Thing Well



No. 51-2, the Boiler Water Feeder and Low Water Cut-off combination that fits most school jobs. For steam and hot water space heating boilers. Other combinations to fit all boilers.

230 Series Pressure Relief Valves for hot water space heating boilers. Meet ASME Boiler Code in every respect; rated and certified by the National Board.

No. 150 Pump Control, Cut-off and Alarm Switch. For boilers up to 150 lbs. The most widely used, time-proved control of its type. Also available with integral water column, as No. 157.

McDONNELL *Boiler Water Level Controls*

Your Boiler Deserves Them

Something MORE than Copper Tube goes into this easy to handle package!

Architects . . . Builders . . . Contractors have come to recognize the "Readi-Pakt" carton as a symbol for quality that can be depended upon to help them build good will, as well as their business. They know, too, that it stands for *Personal Service*—the *big plus* that makes the *Big Difference* at Reading—streamlined, "Shirt-Sleeve" Service . . . from our top brass on down . . . service that eliminates delays and speeds delivery, from mill to distributor to contractor. It's a symbol for Copper Tube made by "Specialists" in the industry—because Reading makes tubing, and *only* tubing, in one of America's most modern, completely integrated mills. By specializing, we can deliver a better product to you—a product you will be proud to deliver too. Next time you are in need of Copper Tube, specify *Reading* Copper Tube and discover the BIG DIFFERENCE.

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DALLAS, TEXAS 9000 Sovereign Row Brook Hollow Industrial District
ATLANTA, GA. 690 Murphy Ave. S.W., Unit 5, Bldg. B

Tenants are happy...

a thermostat in every room

Owners are happy..

steam costs cut 49.5%

A new kind of central heating with individual room control

THE EVERETT BUILDING (shown above) is Akron's oldest office building, dating from 1870. Previously it was heated by a low pressure steam radiator system. In January, 1955, an Iron Fireman SelecTemp heating system was installed, substituting small, compact room heating units for the bulky steam radiators. Each room now receives filtered and circulated warm air, heated by steam, with *a thermostat in every room.*

Tenants control temperature of each office

The results, in tenant comfort and steam savings, have been spectacular. One tenant, (Mr. James F. Mumper, Consulting Heating Engineer) says: "We have experienced sub-zero temperature with high winds. Our office has been held at an ideal temperature, with almost no variation up or down. It is so comfortable one never thinks of temperature. We now consider this SelecTemp system the most marvelous and satisfactory heating installation we have ever seen, and expect to specify it in many of our own jobs."

Another tenant, a physician, found in SelecTemp heating the ideal solution to an old problem. His examination room can be held constantly at a higher-than-average temperature, for the comfort of his patients, while his waiting room and offices remain at 72 degrees.

The Ohio Edison Company, which supplies steam to the Everett Building, made a detailed degree-day study of the building's steam consumption, covering a period of 12 heating months. This study showed a steam saving of 49.5% after the SelecTemp system was installed.

SelecTemp is new solution to old heating problems

Any experienced architect or builder can readily visualize the enormous possibilities of SelecTemp heating in such buildings as hospitals, hotels and motels, schools, office buildings, apartment houses, institutions and buildings of any type, both for new construction and modernization. It will pay you to get the facts now about this revolutionary modern development in heating. The coupon below will bring full information.

IRON FIREMAN®

Finest in heating and cooling

OIL • GAS • COAL

THE IRON FIREMAN

IRON FIREMAN MANUFACTURING CO.
3045 W. 106th Street, Cleveland 11, Ohio.
In Canada, write to 80 Ward Street, Toronto, Ontario.
Send literature on Iron Fireman SelecTemp heating.

Name _____

Address _____

City _____ State _____

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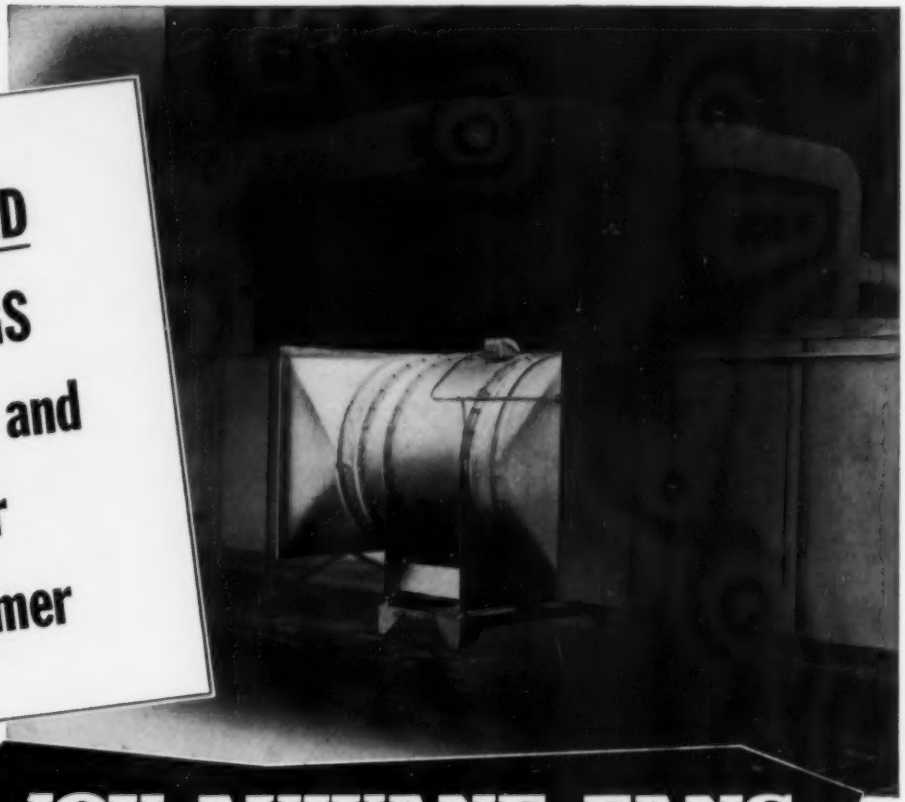
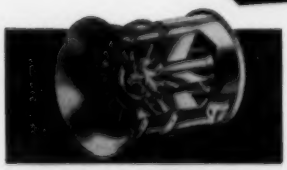
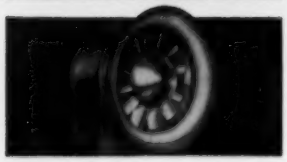
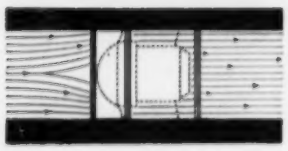


with JOY AXIVANE FANS







SAVE POWER The unique vaneaxial design utilizes aerodynamic blades with close tip tolerance. Internal vanes recover the rotative energy of the air from the blades and convert that energy to velocity and pressure. Result: high performance at low cost.

SAVE SPACE In-line design permits installation right *in the duct.* The photograph above, at Minneapolis-Honeywell Company, illustrates this feature. The fan, which supplies air to two large floors, utilizes an area only 54" in diameter and 26½" long. Result: exceptional economy of space.

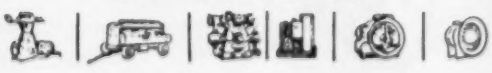
SAVE INSTALLATION COSTS In-the-duct mounting of Joy Axivane Fans is easily and quickly accomplished, and requires only the simplest supports. Result: reduced labor time and costs.

Thus, the remarkable efficiency of the Joy Axivane Fan design . . . in contrast with other air-moving machines . . . gives you great savings in power, space, and labor. . . . And remember, the bigger the job, the greater the margin of benefit you enjoy. For full details, write ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Write for FREE Bulletin 55-41

Consult a Joy Engineer

for VANEAXIAL FANS • COMPRESSORS • OXYGEN GENERATORS VACUUM PUMPS AND BOOSTERS



WSW 15956-55

JOY

WORLD'S LARGEST MANUFACTURER OF VANEAXIAL-TYPE FANS

LQ600 VALVES

• NO LEAKAGE • NO EROSION
• NO WIRE DRAWING
. . . In 100,000 applications and 5 years of tests

Famous LQ600 Bronze Valves, with revolutionary Brinalloy seats and discs, now solve maintenance problems in a new wider range of services!

The lower pressure LQ600-150 made valve history during five years of cost-cutting use in a big variety of installations, ranging from "normal" to "exceptionally severe."

Now the higher pressure LQ600-200 offers all the same proved features — plus a stronger body and bonnet of exclusive Lunkenheimer S-1 Bronze. It has a total temperature rating of 550°F.

It will pay you to specify and install LQ600 in your toughest 150 and 200 lb. services. New Brinalloy seats and discs resist wear and corrosion to an amazing degree — far greater than 500 Brinell Stainless Steel . . . even outwear case hardened Stainless Steel exceeding 1000 Brinell. The flat seats and discs are micro-optically lapped to a perfect fit — and brazed in to stay.

Call your Lunkenheimer distributor or write The Lunkenheimer Company, Box 360, Cincinnati 14, Ohio.

• BRONZE • IRON • STEEL • PVC

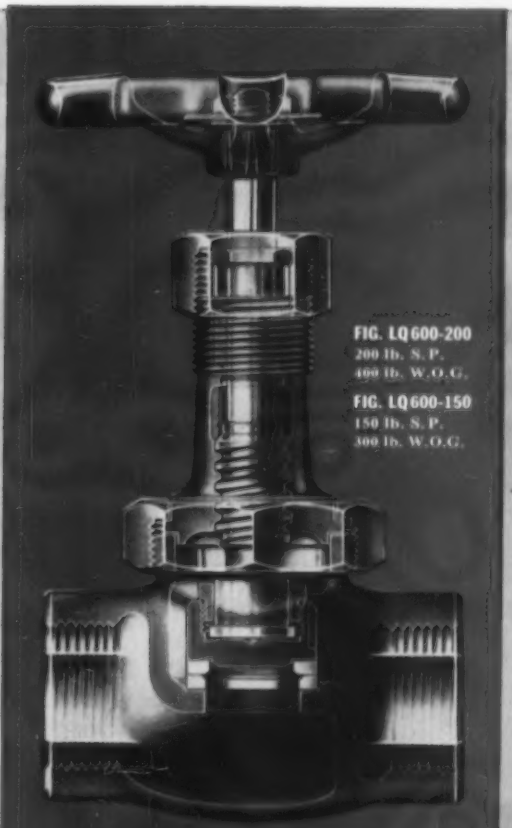


FIG. LQ600-200
200 lb. S.P.
400 lb. W.O.G.

FIG. LQ600-150
150 lb. S.P.
300 lb. W.O.G.

NOW AVAILABLE FOR
200 LB. S.P. 550 F. 400 LB. W.O.G. and
150 LB. S.P. 300 LB. W.O.G.
APPLICATIONS

BRINALLOY* SEATS AND DISCS

*Patented Alloy —TM Reg.

LUNKENHEIMER®
THE ONE *Great* NAME IN VALVES

L-956-28

THE SIZE, SHAPE AND QUALITY...

to fit your job best!

CHASE COPPER SOLDER-JOINT FITTINGS

Efficiency comes naturally to refrigeration and air conditioning systems made with Chase wrought copper solder-joint fittings! Flow of coolant is bound to be smooth and rapid. Flawless Chase fittings have no shoulders or rough interiors to cause turbulence or increase friction.

Couple Chase wrought fittings with Chase copper tube for *really outstanding* performance. They fit each other perfectly. Expand and contract as one rugged unit.

Use Chase wrought copper solder-joint fittings, clean-capped Chase Type L tube, and Chase extra-soft copper refrigeration tube. Your Chase wholesaler has a complete selection right on hand. Send him an order today!

Chase

BRASS & COPPER CO.

WATERBURY 20, CONNECTICUT
SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass, Copper and Stainless Steel

Atlanta Baltimore Boston Charlotte Chicago Cincinnati Cleveland Dallas Denver Detroit Grand Rapids Houston Indianapolis Kansas City, Mo. Los Angeles Milwaukee Minneapolis Newark New Orleans New York Philadelphia Pittsburgh Providence Rochester St. Louis San Francisco Seattle Waterbury

MADE *for each other...*

to do a better job for you!

CHASE® Type L Copper Tube and Wrought Solder-Joint Fittings

Accuracy is the keynote in Chase's manufacturing process for Type L copper tube and wrought solder-joint fittings for refrigeration and air conditioning. Inside and outside diameters are "right on the button." Metal of tube and fittings is identical. They fit each other perfectly—expand and contract *as one unit!* They're smoother, flawless! Straight lengths of tube can be obtained capped for cleanliness.

Your Chase wholesaler stocks coils and straight lengths of Type L copper tube in a wide range of sizes, and individually packaged coils of Chase extra-soft copper refrigeration tube. He also has Chase wrought solder-joint fittings in many styles and sizes. Order today!

Chase®

BRASS & COPPER CO.

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass, Copper and Stainless Steel

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Charlotte	Denver	Los Angeles	Philadelphia	Seattle
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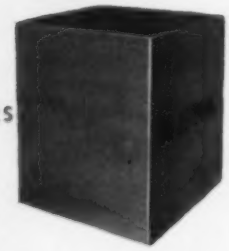
QUALITY
has no substitute

Use **KRITZER**

heating and cooling equipment for profit and top performance

DUAL-VECTOR®

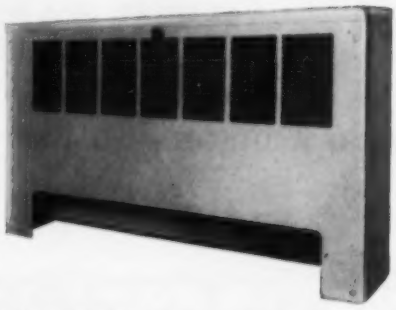
Low cost, combination heating and cooling units for residences, apartments and motels. Two models fit between studding. Easy installation. Clean, filtered air both summer and winter. Insulated enclosures prevent condensation. Individual room control optional. Free-standing types for remodeling.



HYDRO-PAC® WATER CHILLERS

Completely packaged. Factory tested. Ready for easy field installation. Fine "furniture" steel cabinets with baked enamel finish. Five year warranty on hermetic system.

UNIT HEATERS Horizontal and vertical discharge, propeller fan types. Wide selection of sizes for steam and hot water. Die formed cabinets of heavy gauge steel. Baked-on, gray hammer enamel finish. Rubber mounted motors. Dynamically balanced fans in deep drawn venturi for quiet operation.



CONVECTOR-RADIATORS Floor, wall hung and recessed models. Famous KRITZER coil construction for steam and hot water. Bronze headers. Heavy, reinforced steel cabinets. Full range of sizes. Chain or knob operated dampers. Cabinets phosphatized. Gray prime, baked-on finish.

"K" LINE RADIANT BASEBOARD

Clean, modern lines. Quiet. Easy to install. For homes, apartments, offices.

STB RADIANT BASEBOARD

For hard-to-heat areas. Large heating capacity. Safe, rounded corners and edges.

TYPE "R" AIR BASE WARM AIR BASEBOARD

Adds beauty to any home. Efficient warm air heating or cooling. Two and four foot lengths. Built to last.

ASK YOUR JOBBER FOR KRITZER PRODUCTS

"IF IT'S KRITZER, IT'S RIGHT, SIR!"

KRITZER RADIANT COILS, INC.
2901 Lawrence Ave. • Chicago 25

KRITZER

INTERESTING FACTS ON VALVE PERFORMANCE

(from a case history in Crane's files)

20-year veterans—all— with Crane "one-cost" service records

What better hedge could a power plant have against high maintenance costs?

Call it foresight or sound buying practice, the Fort Bend Utilities Co., Sugar Land, Texas, knows the bigger value in quality steel valves.

For 20 years now, these Crane 600-pound gates shown above have been operating with no added cost beyond original investment, except for occasional repacking.

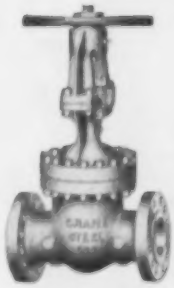
The valves are on a main header, with working pressure at 400 psi, 750 deg. F.

As a subsidiary of Imperial Sugar Co., the Fort Bend Utilities plant supplies steam to the neighboring Imperial Sugar refinery through the valve shown being operated.

This 8-in. Crane No. 76XR steel gate has to its credit 20 years of faithful once-a-week operation with the refinery's weekend shutdowns. The other valves on the header assure dependable steam control to units in the power plant.

Service records like this result from internal valve quality. They begin with the greater care Crane gives to design, castings, heat treating, and machining. It's what's inside that counts in assuring better performance and lower maintenance costs.

You'll make a sounder investment in steel valves by knowing the facts on Crane quality. Contact your local Crane Representative or write to address below.



CRANE VALVES & FITTINGS

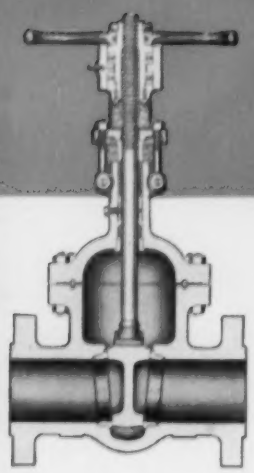
PIPE • KITCHENS • PLUMBING • HEATING

More Facts on Steel Valves— See Over

Since 1855—Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas

You're not getting this quality unless they're

CRANE STEEL VALVES



Don't ever make the mistake of taking steel valve quality for granted. Other makes may even look like Crane, but that's as far as the resemblance goes.

In Crane quality only do you get pioneering skill in casting steel valves with the high development of today's metallurgy techniques. Nor is there a substitute for the extra care Crane gives to machining, assembly and testing, with facilities that have no equal.

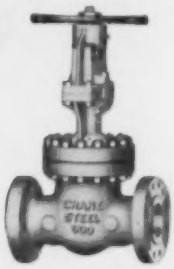
With 100 years' flow control engineering experience, Crane puts the finest features into a complete line of steel valves for power plant services.

These valves are your best assurance of dependable, low-cost control of steam, water, air, gas, etc., at all operating pressures and temperatures.

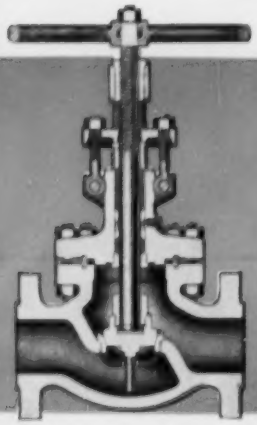
CRANE STEEL WEDGE GATE VALVES

Screwed, Flanged or Welding Ends
Sizes up to 24 in.
In 150, 300, 400, 600, 900, 1500, and 2500-Pound Pressure Classes

Cross-section shows 600-pound gate pattern. Note balanced ruggedness with features such as fully guided disc, non-rigid T-head disc-stem connection, deep, generous size stuffing box, and straight-through flow.



900-pound gate pattern, flanged ends

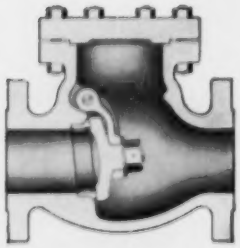


CRANE STEEL GLOBE AND ANGLE VALVES

With Plug-Type or Ball-Type Disc
Screwed, Flanged or Welding Ends
Sizes up to 8 in.
In 150, 300, 400, 600, 900, 1500, and 2500-Pound Pressure Classes

Cross-section shows 600-pound globe pattern with plug type disc and seat, recommended for steam services. Note the powerful stem and yoke for positive closure, the free-swivel disc-stem connection, the self-equalizing ball gland, and deep stuffing box among other features.

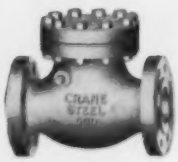
300-pound angle pattern, flanged ends



CRANE STEEL CHECK VALVES

Swing Type
Screwed, Flanged or Welding Ends
Sizes up to 12 in.
In 150, 300, 400, 600, 900, 1500, and 2500-Pound Pressure Classes

Cross-section shows 300-pound swing check, flanged ends. Note full-port area from inlet to valve seat to avoid turbulence, and generous body area to outlet, to minimize erosion and flow resistance.

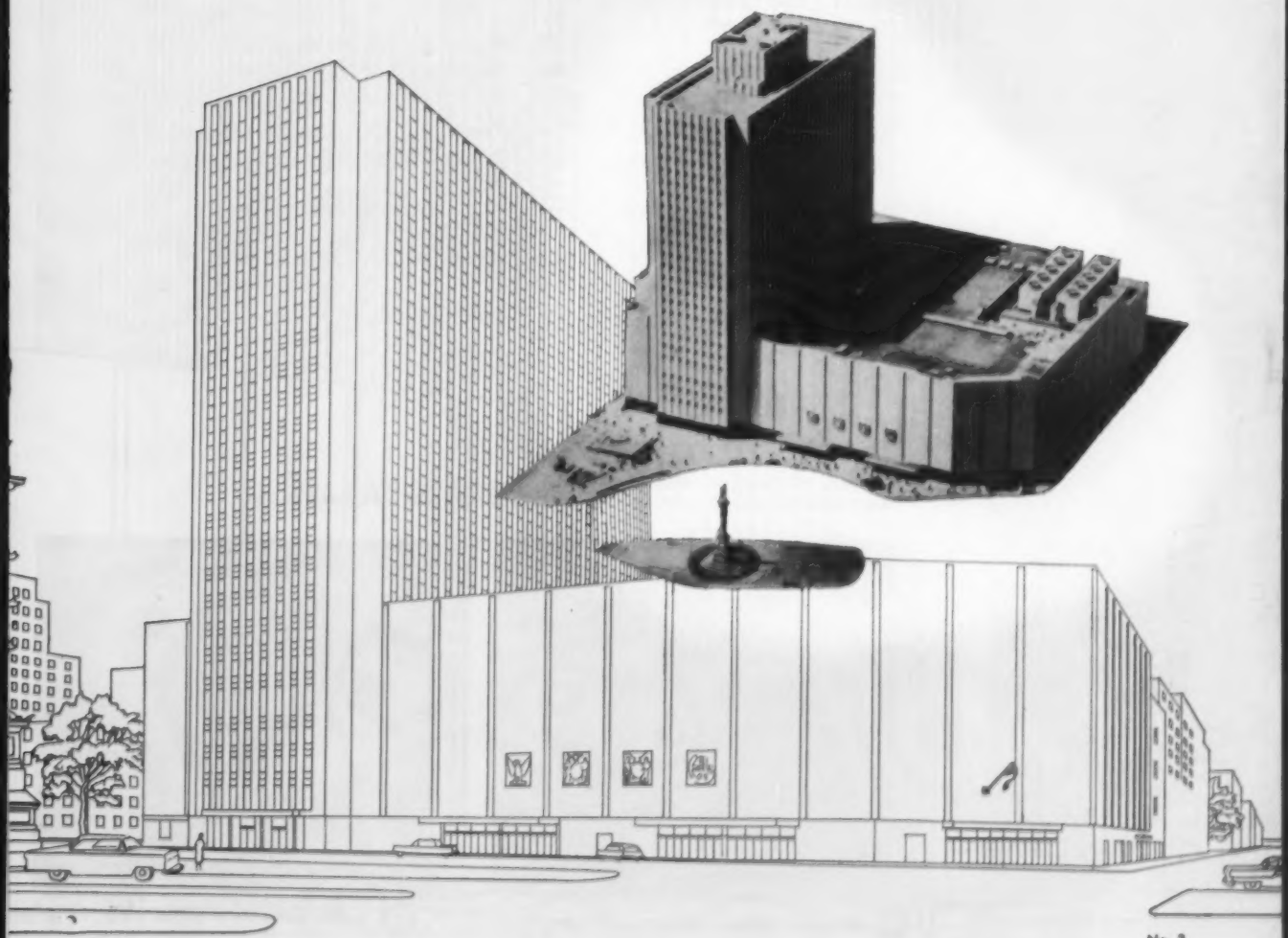


600-pound swing check valve, flanged ends

YOUR COMPLETE GUIDE TO STEEL VALVES

Your Crane Catalog leads you quickly to the best choice of valve for each need. It gives you plus information—all you need and more to answer any likely questions. You'll appreciate its comprehensive description of materials and design features . . . the complete dimensional data . . . and service recommendations. You get more in every way from your Crane Catalog and your local Crane Representative.

Tuttle + Bailey equipment installed
to handle air distribution requirements
in New York's fabulous "showplace of shows"

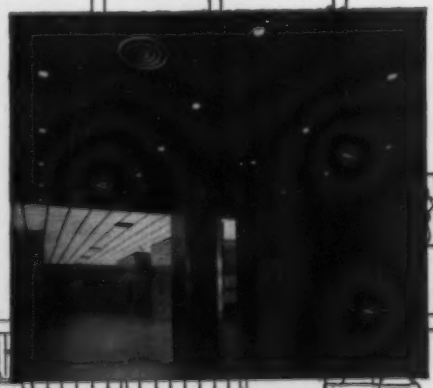


No. 3

Providing year-round air-conditioned

ARCHITECT — Leon and Lionel Levy
MECHANICAL ENGINEER — Guy B. Panero
GENERAL CONTRACTOR — Walsh-Fuller-Slattery
AIR CONDITIONING, HEATING AND VENTILATING CONTRACTOR — Almirall & Co., Inc.

A Progress photo in 20-story office tower.



B Lobby entrance of office tower.

comfort in New York Coliseum posed unusual mechanical problems

. . . solved with an integrated high and low pressure system utilizing Tuttle & Bailey air distribution equipment.

A In the 20-story office tower, a high pressure double duct system extends up through two vertical shafts. Two Tuttle & Bailey temperature mixing units on each floor supply blended proportions of heated and cooled air to Tuttle & Bailey sound attenuation units located in the suspended ceiling. Structurally, this unique system minimized the duct space required above the ceiling. Performance-wise, it provides two interior zones on each floor to meet varying temperature requirements of tenants.

B In the striking lobby entrance of the office tower, low pressure Tuttle & Bailey diffusers blend with the lighting motif.

C In the entire length of the impressive 300 ft. lobby entrance to the main exhibition hall, Tuttle & Bailey low pressure supply and return grilles are installed on alternate sides of the square luminous lighting modules.

D Throughout the mezzanine exhibition areas, 8 ft. lighting modules are set into a waffle-type slab ceiling. Tuttle & Bailey high pressure sound attenuation units are located in the center of each module. High pressure ducts formed in the slab ceiling are connected with main supply ducts at the building perimeter, resulting in a zone control single duct type of system.

E The dramatic, spacious main exhibition area is conditioned from a height of 65 ft. with Tuttle & Bailey diffusers located in the vast structural network.

If you have a specific air distribution problem involving a low or high pressure system, Tuttle & Bailey's Engineering Department will welcome the opportunity to be of help. Address: R. D. Tutt, Chief Engineer, Tuttle & Bailey, New Britain, Connecticut.

TUTTLE & BAILEY

division of Allied Thermal Corp. New Britain, Connecticut

C Lobby entrance of exhibition hall.

D Portion of mezzanine exhibition area.

E Main exhibition area

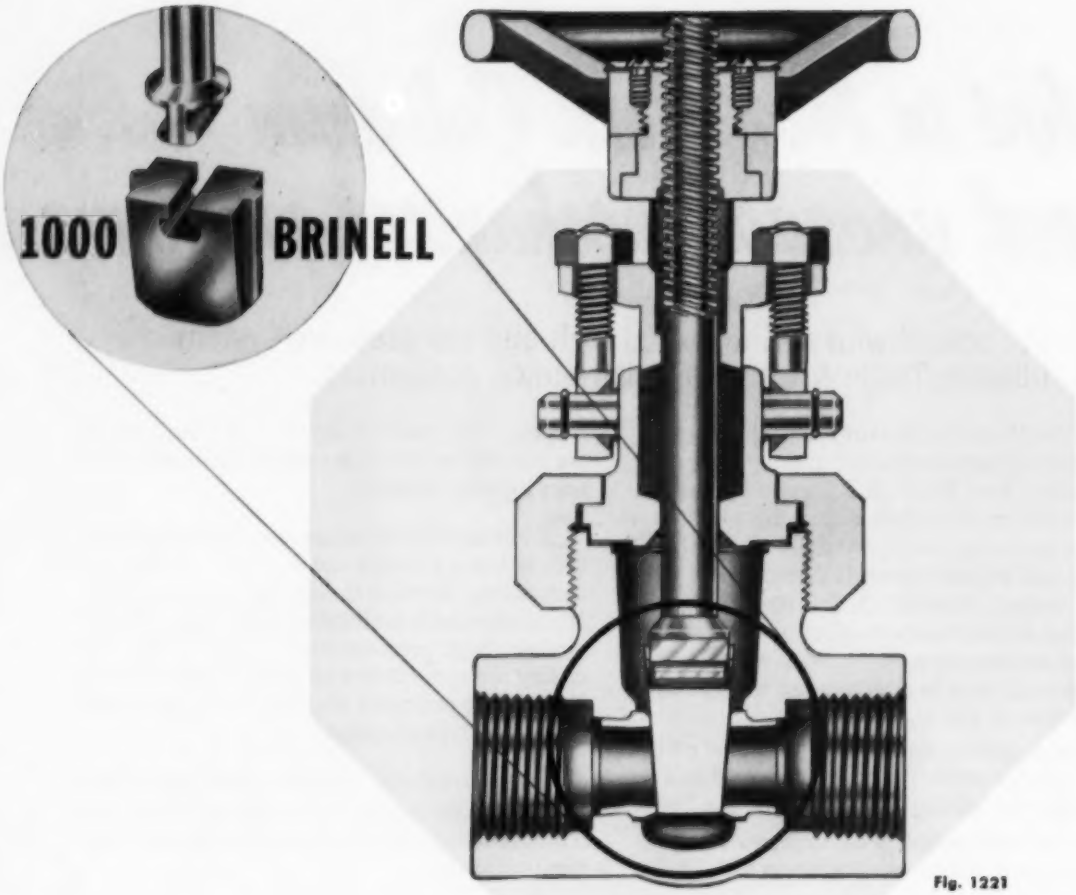


Fig. 1221

Stop Galling with the hardest valve wedges you can buy

Especially suited for high temperature hot water heating

Here's a wedge as hard as flint . . . so hard that it's undamaged by pipe cuttings, scale or grit. It's the only trim we know of which will successfully withstand the simultaneous attack of the three valve-destroying agents—corrosion, erosion, galling. This wedge is *13% chrome stainless steel hardened up to 1000 Brinell.*

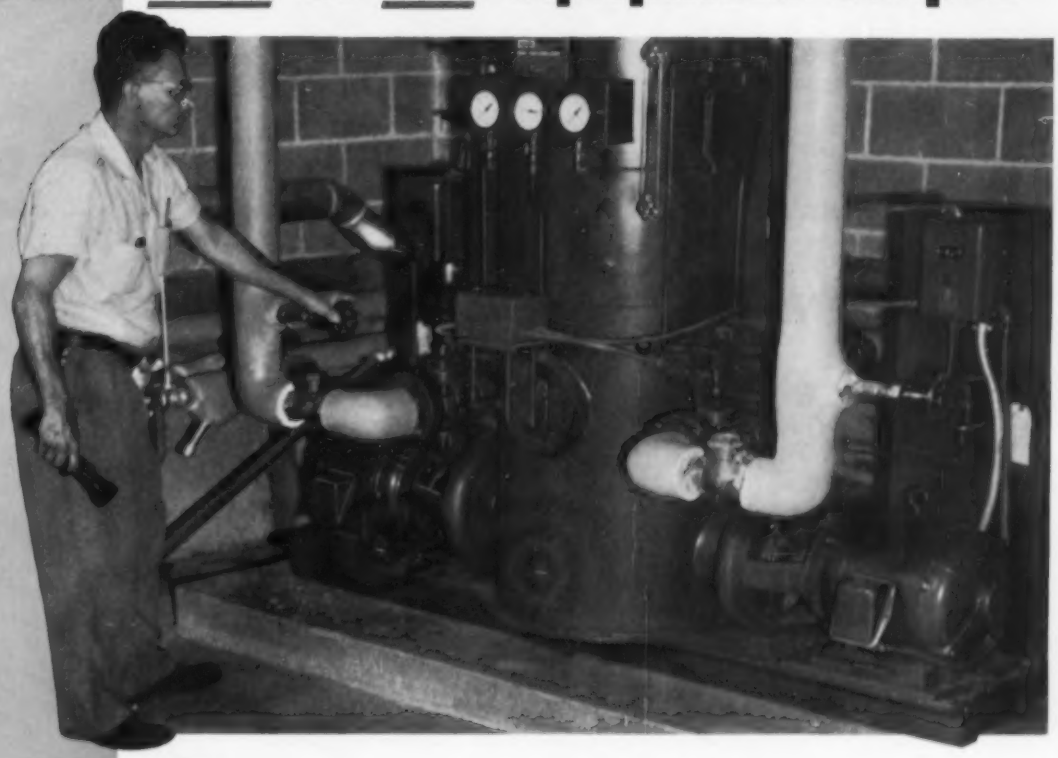
Specify the OIC 1221 gate or 1621 globe where you need the extra rugged nature of forged steel. They are recommended for steam service up to 800°F...oil service up to 1000°F. Or, use these same valves for hydraulic service up to 2000 lbs.

Write for Form 195 for specifications on the OIC forged steel line.

OIC VALVES | FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON VALVES

THE OHIO INJECTOR COMPANY
WADSWORTH, OHIO

You're *sure* of *full* equipment output



65,000-ft. EDR Capacity, Duplex Type Vacuum Return Line Heating Pump . . . powered by two 5 H.P. 1750 R.P.M. Close-Coupled Century Performance-Rated Motors.

with Century Performance-Rated© MOTORS

When your equipment is driven by Century Motors, you can be sure of top performance! The reason? Century offers an unusually wide range of size, speed, frame and torque characteristics to choose from. Equipment manufacturers can provide you with *exact* application of motor to job.

For circulating pumps, compressors, cooling towers, fans, blowers, stokers . . . whatever the installation, you'll be ahead with precision performance and customer satisfaction when Century Motors are furnished. Specify Century for replacement motors, too . . . call or write your nearby Century District Sales Office or Authorized Distributor.

Performance-Rated© MOTORS 1/20 to 400 H.P.

CENTURY ELECTRIC COMPANY

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Remarkable New Hides Completely.

NEW multi-vent® TROFFERLITE
THE DUAL PURPOSE FIXTURE
WITH 8 OUTSTANDING ADVANTAGES

FOR ARCHITECTS . . .
Insures clean functional ceiling design.

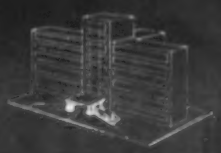
FOR ENGINEERS . . .
Simplifies planning.

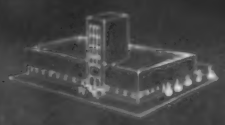
FOR CONTRACTORS . . .
Simplifies field installation.

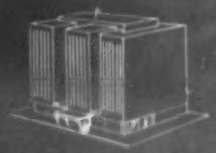
1. Air is gently diffused downward using pressure displacement principle, instead of high velocity air injection. Results: *draft-free* air conditioning.
2. Fewer fixtures and fewer installations needed, because air diffuser and illumination are in the same fixture. Big savings!
3. Temperatures remain uniform throughout the room. The pressure displacement principle simplifies field balancing.
4. Makes in-progress or after-completion changes easy and economical, with little inconvenience.
5. No dirt smudges on adjacent ceiling materials.
6. Partitions can be moved without interfering with air conditioning efficiency. There is no "throw" or "blow" because air is gently diffused downward.
7. Clean ceiling design . . . only the modern light fixture shows in the ceiling . . . no air diffusers. Highly efficient units provide control illumination for any lighting situation.
8. Concentrate air conditioning where you need it, over "hot" spots (where people or machines are concentrated). Conversely, where minimum air conditioning is needed, fixtures can remain unattached to air duct, or shut off.

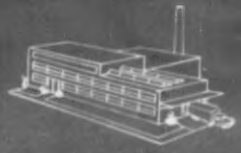
IDEALLY SUITED FOR APPLICATIONS IN:

OFFICE BUILDINGS AND STORES

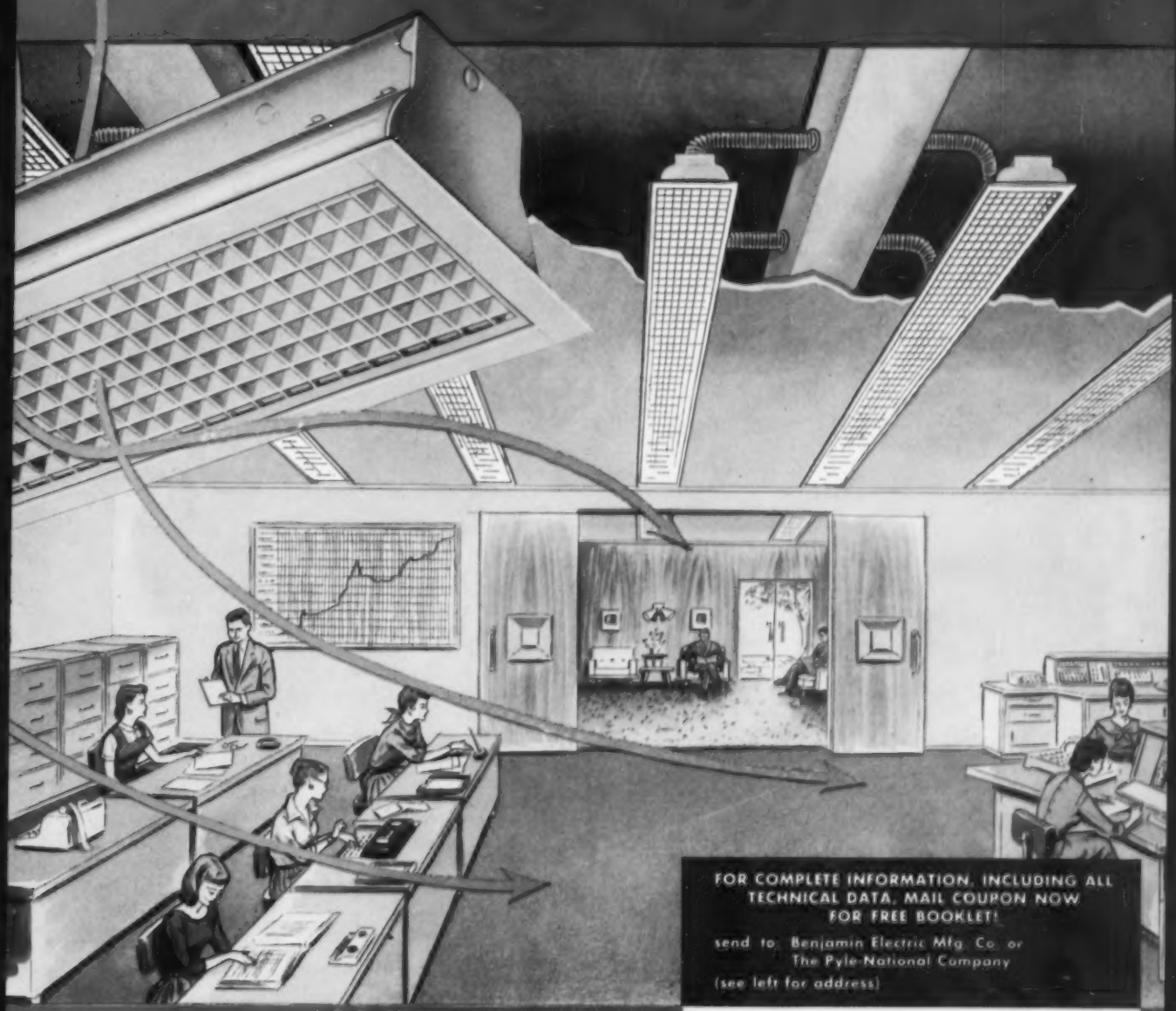

HOSPITALS


SCHOOLS


HOTELS AND RESTAURANTS


LABORATORIES

Air Diffuser in a light fixture!



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send to: Benjamin Electric Mfg. Co. or The Pyle-National Company (see left for address)

Dear Sirs: Please send me your free booklet on the Multi-Vent Trofferlite, the light fixture that diffuses conditioned air.

NAME_____

FIRM NAME_____

ADDRESS_____

CITY_____ STATE_____

Jointly designed and engineered by

BENJAMIN ELECTRIC MFG. CO.
Des Plaines, Illinois

AND

The PYLE-NATIONAL COMPANY
Chicago 51, Illinois

THERMOTANK'S *HIGH-VELOCITY* AIR CONDITIONING SELECTED BY FABULOUS GM TECHNICAL CENTER

At the left is the main entrance to the Styling Administration Building and in the background is the domed Styling Auditorium, two of the seven buildings air conditioned by Thermotank, Inc.

This executive office in the Research Administration Building shows a typical installation of Thermotank's custom-designed air diffusers with integrated sprinkler heads.

IN co-operation with General Motors' engineers, Eero Saarinen & Associates, architects, and Smith, Hinchman & Grylls, Inc., architect-engineers, Thermotank, Inc., helped design a new high-velocity, double-duct air conditioning system for seven of the buildings in the magnificent General Motors Technical Center. Using techniques developed through 30 years' experience in moving air at high speeds through tight spaces, Thermotank engineers provided a streamlined duct design with noiseless Thermo-Reg mixing boxes and high-velocity ejection ceiling diffusers, which incorporate sprinkler heads and are integrated with the ceiling acoustical treatment. Thermotank invites inquiries about further details of this advanced system of high-velocity, year-'round air conditioning.

GENERAL MOTORS TECHNICAL CENTER

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Tough Expansion Joint Problem?

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Complex expansion joint problems are *best* analyzed at only one place: your office or plant site. It's there alone that *all* essential data about your proposed installation is available.

And it's there — *on the spot* — that the Badger Man is ready to apply his unique abilities. He is a trained engineer *and* he brings to your problem the background of the world's most experienced manufacturer of expansion joints.*

Next time you are confronted with a complicated piping layout, severe operating conditions, unusual size and shape requirements — *any* complex expansion joint problem — put the Badger Man on the spot! His services are as close as your telephone.

COMING SOON — Badger Service-Rated Expansion Joints. Incorporate revolutionary new features developed during three years of intensive research and testing. Watch for this important announcement.

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BADGER MANUFACTURING COMPANY

230 Bent Street, Cambridge 41, Massachusetts • 60 East 42nd Street, New York 17, New York

Representatives in principal cities

*Badger has been solving tough expansion joint problems for 50 years — a record unmatched by any other firm.

Horne's main store in Pittsburgh has 28 filter stations with banks ranging from 10 to 48 filters each. Pittsburgh Glasfloss Filters are used exclusively. The system was installed in 1937.

Howard F. Burrell, Chief Engineer, reports that Pittsburgh Glasfloss Filters are easy to handle, soft and light weight; and that this Fiber Glass filter does not splinter or shred.

"We effected a direct unit saving of 13% by switching to Pittsburgh Glasfloss Air Filters"

—says Howard F. Burrell, Chief Engineer
JOSEPH HORNE CO., Pittsburgh, Pa.

"The filters we previously used in our store-wide air conditioning system would shred and stick to fingers and clothing when handled," reports Mr. Burrell. "They were not uniform in quality and their performance was erratic.

"We switched to Pittsburgh Glasfloss Filters in February, 1956. We found Glasfloss Filters much easier to handle. They are lighter in weight and safer, too; this Fiber Glass does not splinter or shred. What's more, Glasfloss lasts longer, making it possible for us to effect a 13% saving over filters previously used.

"From an engineering point of view, we consider Glasfloss the most practical, economical and dependable filter possible to obtain for our system!"

Glasfloss Filters Will Give You Best Results, Too!

Pittsburgh Glasfloss Filters are made of fine, soft Fiber Glass, which provides greater dust-collecting areas without interfering with the air flow. They are moisture proof and fire resistant. Glasfloss Filters will give you top service from your air conditioning system, help you cut costs.

Contact your nearest Glasfloss Distributor or Pittsburgh Plate Glass Warehouse. *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pennsylvania.*

PITTSBURGH GLASFLOSS FILTERS ARE A PRODUCT OF THE FIBER GLASS DIVISION OF PITTSBURGH PLATE GLASS COMPANY

Sales Offices are located in the following cities: Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia and St. Louis

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CURVED CONTOUR cone design provides air diffusion efficiency never before equalled—AT SUCH AN ECONOMICAL PRICE.

NEW!

Unsurpassed beauty . . . the ultimate in modern day design.

NEW!

Easiest . . . fastest in the world to install—adjust.

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The T-1 diffuser is only one Model of Titus' exciting completely new line of CEILING DIFFUSERS AND ACCESSORIES. If you haven't received literature on this new line—WRITE TODAY!

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IN HOT WATER HEATING SYSTEMS

GUARANTEE
B & G Airtrol Systems are guaranteed to prevent the accumulation of air in heating units and prevent noises caused by entrained air in the piping. In case of the failure of any B & G Airtrol System (within the U. S. A.) to operate correctly, when installed in accordance with our published instructions, we will provide, free of charge, the services of a factory-trained engineer who will supervise the changes required to produce satisfactory results.

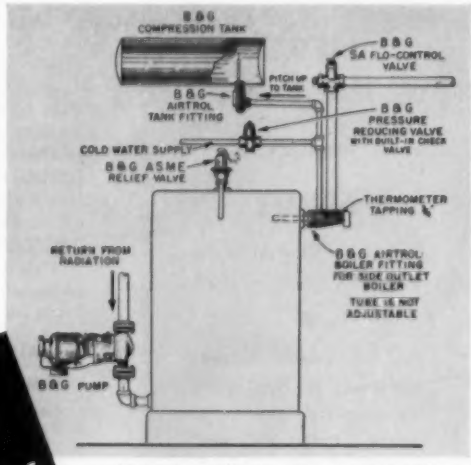
Failure to heat—gurgling in the piping and heating units—waterlogged compression tanks…these common troubles can be charged to *air in the system!* And charged also on your books as the reason for profitless call-backs!

It's easy now to get rid of air troubles for good—with a B & G Airtrol System on every hot water job. Tested and proved in thousands of installations, this patented B & G product eliminates air accumulation in forced hot water heating systems—*solves a problem never before satisfactorily answered.*

The B & G Airtrol System consists of two simple, easily installed parts, the Boiler Fitting and the Tank Fitting. Their combined function is to trap air in the compression tank and prevent its return to the boiler, piping and heat distributing units. All air bubbles are caught where they form—*in the boiler!*

Remember, the B & G Airtrol System is the only *guaranteed* method of controlling air in hot water heating systems.

The B & G Airtrol Side Outlet Boiler Fitting is made in four sizes to fit a wide range of boilers.


B&G COMPRESSION TANK
B&G SA FLO-CONTROL VALVE
PITCH UP TO TANK
B&G AIRTROL TANK FITTING
B&G PRESSURE REDUCING VALVE WITH BUILT-IN CHECK VALVE
COLD WATER SUPPLY
B&G ASME RELIEF VALVE
THERMOMETER TAPPING
RETURN FROM RADIATION
B&G AIRTROL BOILER FITTING FOR SIDE OUTLET BOILER
TUBE IS NOT ADJUSTABLE
B&G PUMP

Typical installation of B & G Airtrol System on side outlet boiler.

For complete information, send for Bulletin No. HM-456

BELL & GOSSETT
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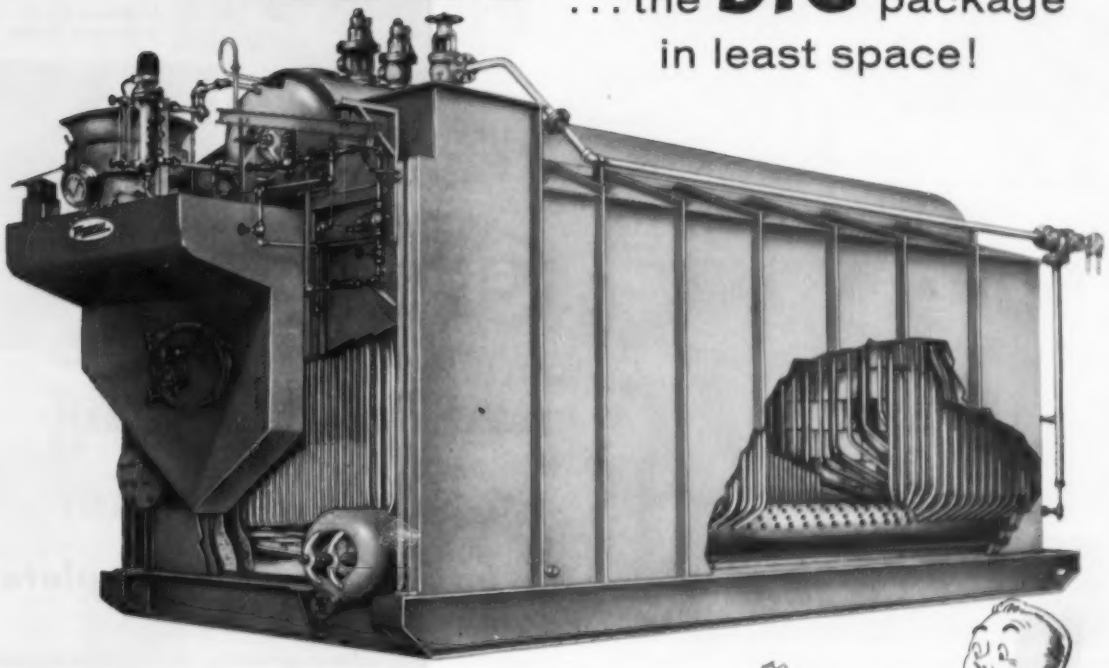
Titusville WTP Steam Generator

... the **BIG** package in least space!



BIG IN CAPACITY (up to 40,000 lbs)

BIG IN PERFORMANCE

BIG IN DEPENDABILITY

Yet Titusville Type WTP Steam Generators offer gratifying space economies in the boiler room. Skilled engineering achieves utmost compactness in every WTP size —easy to transport, easy to install!

The shop-assembled Type WTP unit is a 2-drum, bent tube, water tube boiler—shipped complete with all components in place. It is adapted for firing with heavy oil; combination heavy oil and gas; light oil; combination light oil and gas; natural, coke oven or manufactured gas. Write for full details in new Bulletin 5511.

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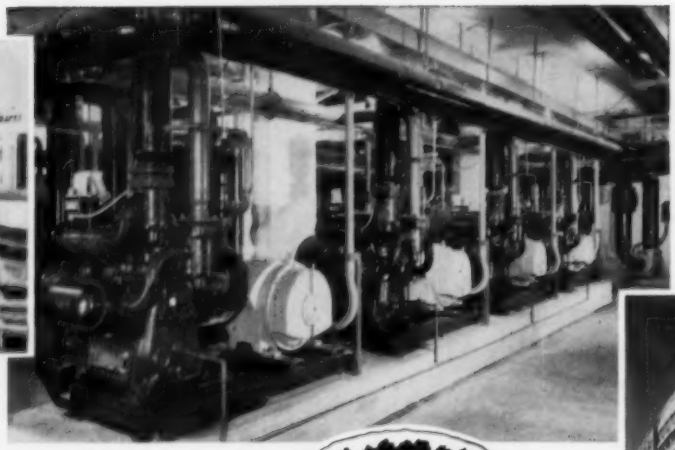
Frick unit air conditioners are built in 3, 5 and 7½ horsepower sizes.



Eight Frick "ECLIPSE" compressors, each with nine cylinders, air condition both the 11-story buildings of the American National Insurance Co. in Galveston, Texas.

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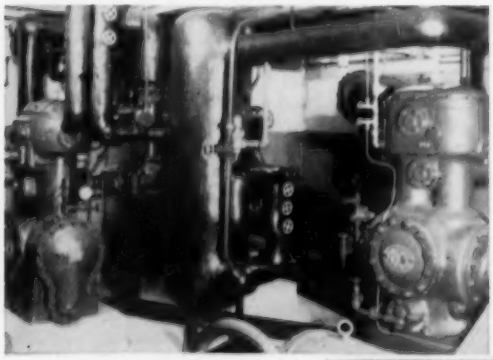
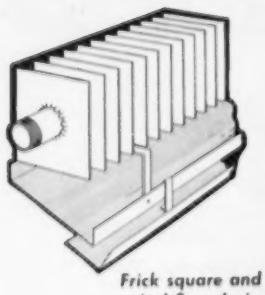
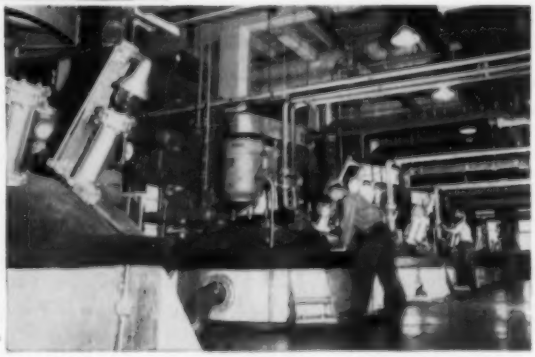
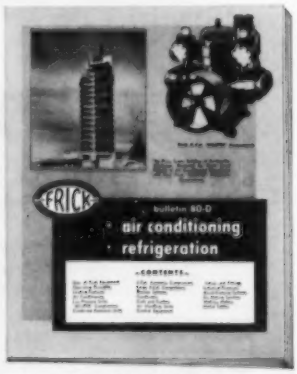


Synthetic-rubber reactors handle batches over twice as fast when cooled with patented Frick coils.



Frick square and spiral finned pipes save valuable space.





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SPECIFY

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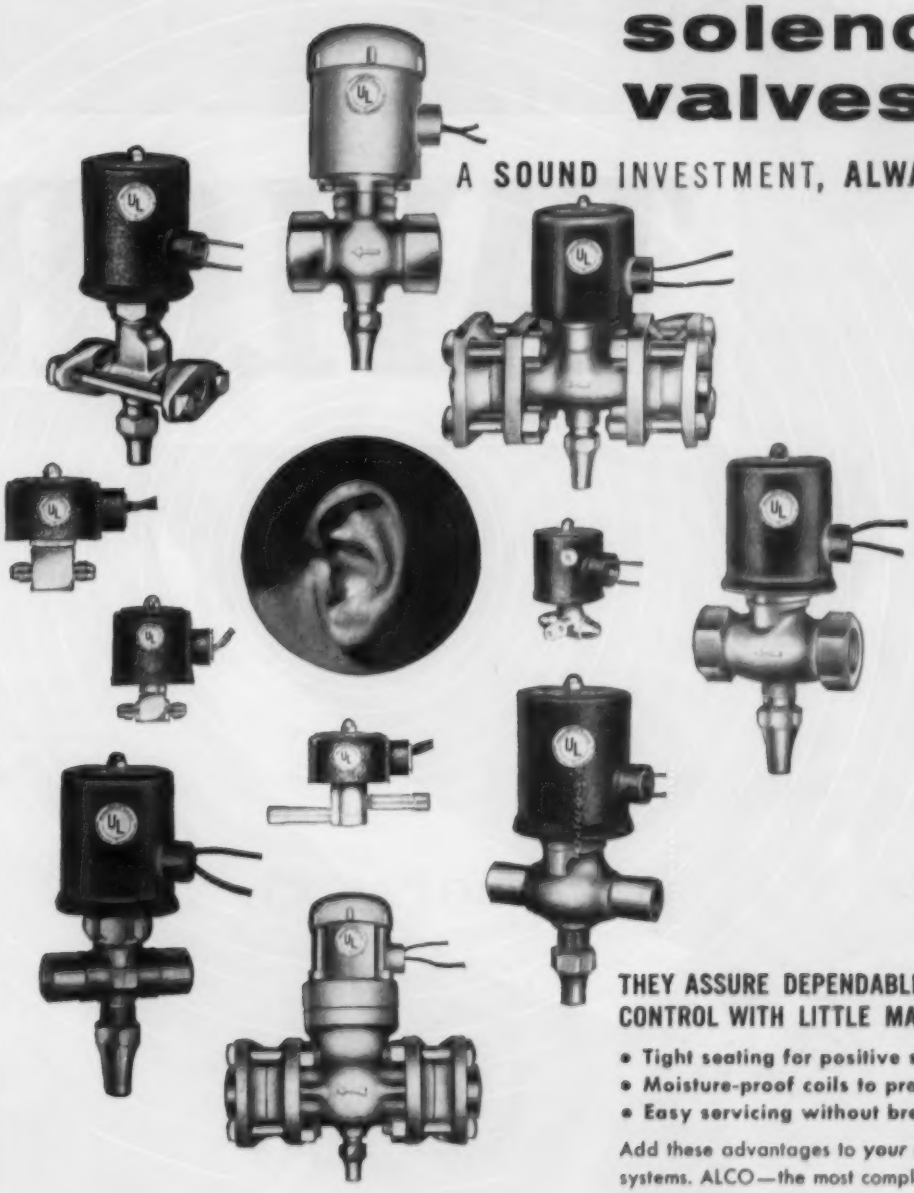
A SOUND INVESTMENT, ALWAYS QUIET



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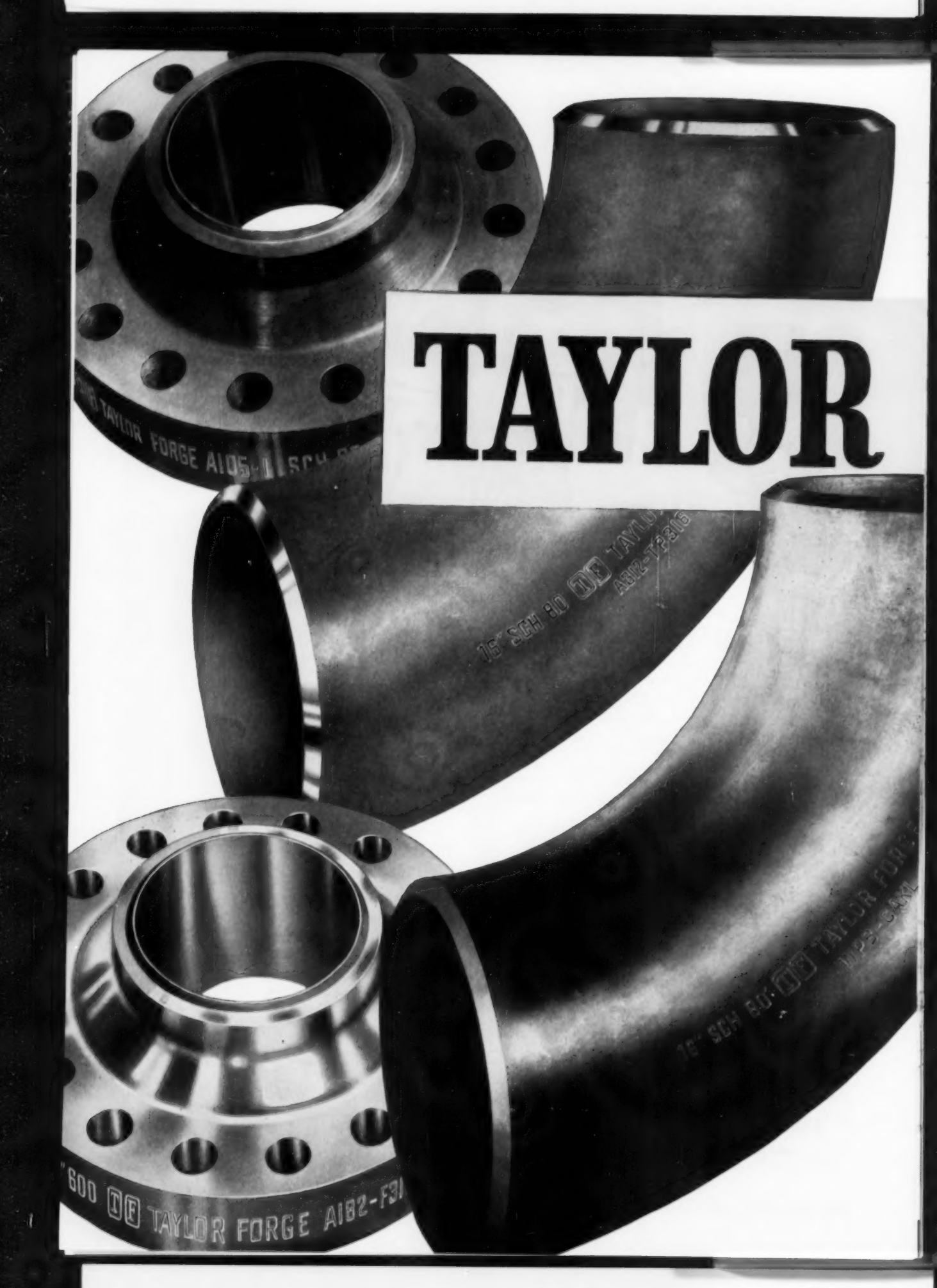
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Taylor Forge Welding Fittings and Forged Flanges . . . backed by 55 years of experience . . . meet all American Codes and Standards. They're available in stainless steels as well as carbon steel and all forgeable materials . . . in every size, type, thickness and pressure rating.

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He carries a full stock of Taylor Forge Welding Fittings and Forged Flanges and can supply your needs promptly. He's a good man to know for he understands piping and through him you have available the services of Taylor Forge engineers for help and advice on any piping problem.

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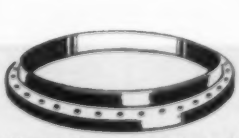


T.E.M.A. flanges and channels

Multiple outlet headers

Production forgings

Venturi reducers

Spiral weld pipe

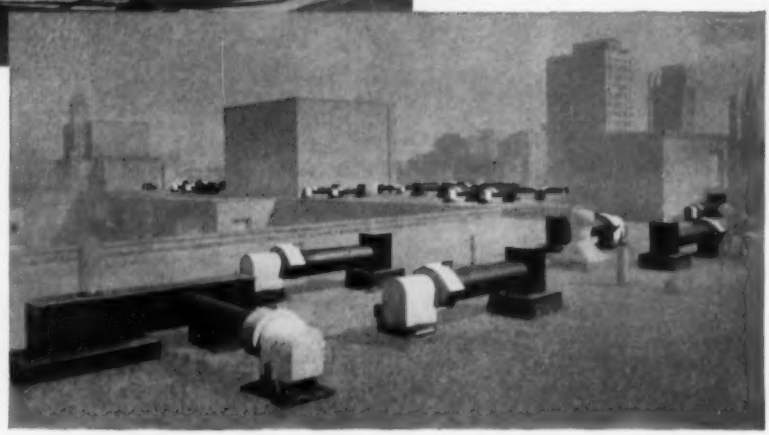
Large diameter electric weld pipe

Welding necks

BIG or SMALL . . .

Peerless Blowers Solve All Types of Ventilation Problems

AT left is a large Peerless Backward Curve Blower installed on the roof of one of the nation's largest automobile body plants. Its job is to draw air from the ceiling of the press room and discharge it, for ventilation purposes, into the press pit which is below ground level.



AT right is a grouping of 39 small Centrifugal Exhaust Blowers on the roof of a 14-story, 299-unit apartment building. They handle about 30,000 cubic feet per minute exhausting odors and stale air from kitchens and bathrooms in the apartments below.

VERSATILITY in size and application has always been a Peerless strong point. Our engineers design to suit the existing conditions. You're not buying "off the shelf" when you specify Peerless Fans and Blowers for a specific exhaust or ventilation problem.

PEERLESS Fans and Blowers are unconditionally guaranteed to meet all established industry test codes (NAFM or PFMA). Their outstanding service records speak well for their dependable performance. 100% factory inspection assures constant top quality.

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THE *Peerless-Electric*® COMPANY

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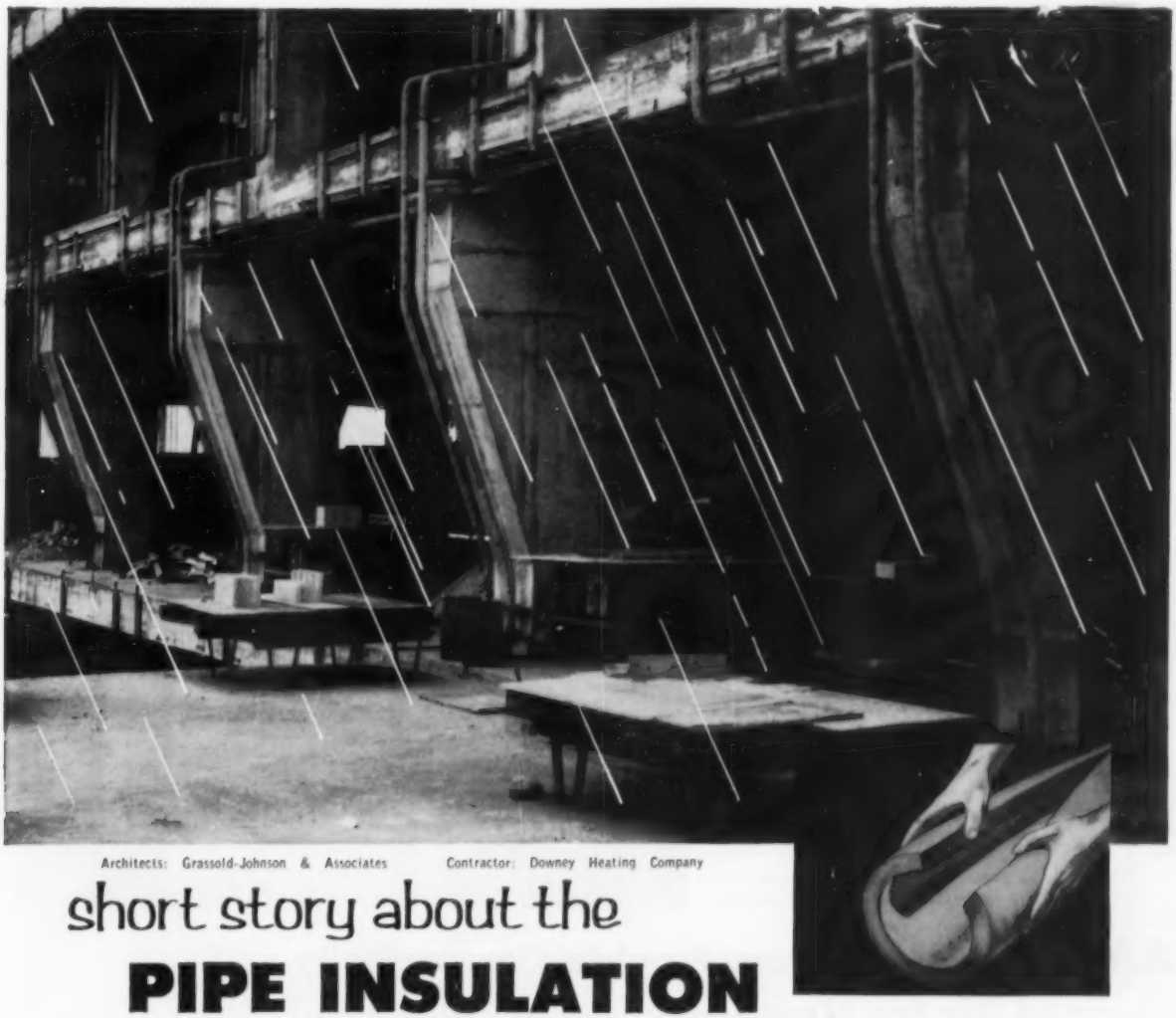
FANS · BLOWERS · MOTORS · ELECTRONIC EQUIPMENT

Write, wire or phone today for Bulletins SDA-160 or SDA-200.

Venturi reducers | Spiral weld pipe | Large diameter electric weld pipe | Welding necks



Architects: Grassold-Johnson & Associates Contractor: Downey Heating Company

short story about the **PIPE INSULATION** that **RAIN** can't **RUIN . . .**

This true story concerns G-B Snap*On, the new one-piece molded pipe insulation of fine glass fibers.

It happened in Milwaukee, in June this year. For 11 days, no one saw the sun—just rain, rain, rain. During this wet spell, G-B Snap*On was exposed to the elements in the partially-completed Central YMCA Building (see photo). Time and again, the insulation was drenched—but when it dried out, it was good-as-new and not a single section needed to be replaced!

This actual case history highlights the fact that G-B Snap*On is totally new and different—the first all-new pipe insulation in 60 years! It won't get gummy or muddy when wet. It won't crack or crumble when dry. It's 4 to 10 times lighter than other pipe insulations. In thermal efficiency, it's superior to any pipe insulation on the market. What's more, Snap*On can be applied much easier and faster on *any* job—and the more intricate the piping, the more Snap*On cuts application costs.

See for yourself—write today for samples and complete technical data.

*Reg. U. S. Pat. Off.

SNAP*ON DISTRIBUTORS IN 58 CITIES ARE LISTED UNDER "GUSTIN-BACON INSULATIONS" IN THE YELLOW PAGES

GUSTIN-BACON *Manufacturing Company* GUSTIN gb BACON

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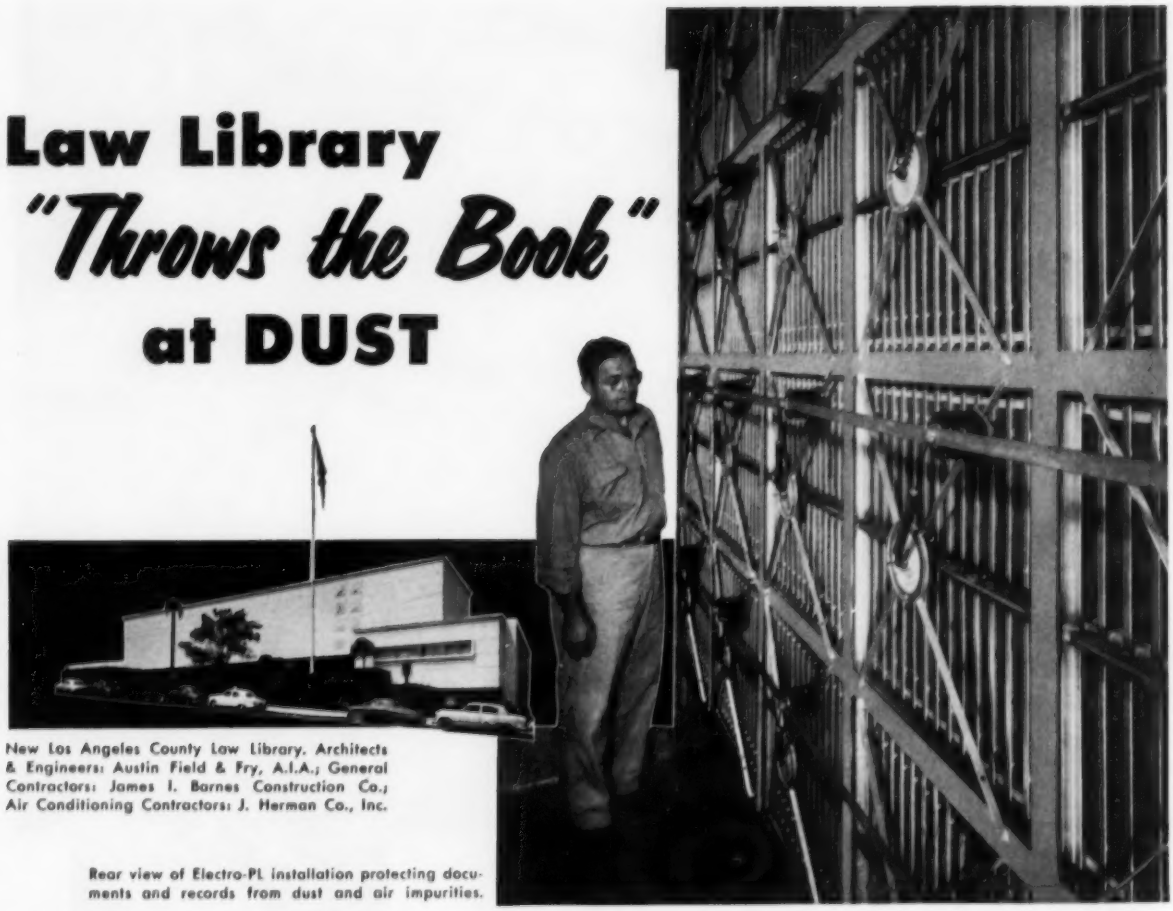
Law Library "Throws the Book" at DUST



New Los Angeles County Law Library. Architects & Engineers: Austin Field & Fry, A.I.A.; General Contractors: James I. Barnes Construction Co.; Air Conditioning Contractors: J. Herman Co., Inc.

Rear view of Electro-PL installation protecting documents and records from dust and air impurities.

AAF Electro-PL Filters Provide Electronically Cleaned Air for New Los Angeles County Building

Damaging dust never had that first chance to "browse around" in this beautiful new Los Angeles County Law Library. The records and documents entrusted to its care were provided with positive protection from dust and other air impurities by the installation of AAF Electro-PL electronic air filters.

The Electro-PL is a dry type electronic filter that gives *twice* the filtering efficiency of ordinary dry filters—at low initial cost. It utilizes electrostatically-charged Airmat paper media and becomes a "new" filter with each media renewal. And it continues to function effectively even in the event of a power failure. The Electro-PL requires no drain or sewer connection—needs no oil. It is simple to install in either straight bank or space-saving "V" arrangement.

For complete product information, call your local AAF representative or write direct for Electro-PL Bulletin 257.

AAF American Air Filter COMPANY, INC.

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AAF Dust Control Equipment

Illinois Heating Specialties

BETTER AIR IS OUR BUSINESS

Herman Nelson Unit Heaters

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The Training Center was named for Commodore William Bainbridge, commander of the famous frigate CONSTITUTION, immortalized in the poem "Old Ironsides."

U. S. NAVY estimates savings of $641,000* annually with 194 Cleaver-Brooks HEV-E-OIL Burners

THE U.S. NAVAL TRAINING CENTER, Bainbridge, Md., trains 50,000 men and graduates 6,000 men a year in advanced technical skills needed for defense. The men are kept comfortably warm by 194 Hev-E-Oil burners, famous for outstanding efficiency, fuel economy and precision construction. The Hev-E-Oil burner uses low-cost No. 5 oil — an oil rich in heat energy, but lower in cost than lighter No. 2 oil. Estimated savings to the Navy amount to $641,000 annually.

In hundreds of other installations all over the world, efficient Hev-E-Oil burners are cutting fuel costs . . . achieving savings that amount to thousands of dollars annually for schools, office buildings, hospitals, apartments and stores.

You, too, will like the quality construction and sound basic design of the Hev-E-Oil burner. It offers full flame modulation, automatic pressure lubrication, low fire start with no puff backs, and accurately metered oil and air for the best in economical performance. Little wonder the Hev-E-Oil burner has proved itself a leader in performance and in sales.

If you own, specify, install or service burners, get all the facts about the burner designed to save you money. Write for illustrated bulletin AD-102 now. Cleaver-Brooks Company, Dept. K, 392 E. Keefe Ave., Milwaukee 12, Wis.

*Official U.S. Navy Records

Hev-E-Oil burner — 7 sizes, 1 to 90 gph — adapts to all standard heating boilers

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Bainbridge Burners sold by Hev-E-Oil Burner Distributors, New York City

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Hev-E-Oil burner will cut your fuel costs

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regardless of Load or Number of Circuits

Buy SPORLAN REFRIGERANT DISTRIBUTORS *with these* 11 *Proven Features!*

1. Sporlan Distributors give the best possible distribution under all conditions regardless of load, number of circuits or evaporator temperature.

2. The Sporlan Refrigerant Distributor is a separate device from the valve, permitting the use of any standard thermostatic expansion valve. No moving parts.

3. Capacity may readily be varied because Sporlan offers interchangeable nozzles.

4. Requires very little space and is easy to install, because all connecting tubes are grouped close together and come off in the same direction.

5. May be applied to any make multi-circuit evaporator. May be installed in any position for any load or evaporator temperature.

6. Wide variety of number and sizes of circuits. Easy selection.

7. Allows internal visual inspection of solder joints at distributor.

8. Permits insertion of test wire to check against plugging of solder joint at evaporator connections.

9. Permits final submerged coil leak test with high pressure before attaching valve.

10. Small body is easy to solder or weld.

11. Steel or aluminum bodies are available in certain distributor types for Ammonia and other special applications.

So... whether you are a packaged unit or coil manufacturer, contractor or service engineer... Sporlan is the Refrigerant Distributor for you... Over 15 years of Peak Performance Leadership speaks for itself.

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EXPORT DEPT. AD. AURIEMA INC., 89 BROAD STREET, NEW YORK 4, N. Y.

Shreveport's ultra-modern Beck Building boasts colored aluminum walls, music in the elevators—and an ingenious air conditioning system that . . .

cools on the sunny side, heats on the shadow side

"We built the Henry C. Beck Building with the thought of providing custom-made office space for tenants," relates Building Manager Edward E. McClung. "Our luxurious wood-paneled offices, mosaic-tiled lobby, music-filled elevators, and our flexible air conditioning system are examples.

"Since the exterior walls expose nearly an acre of glass to the hot sun, temperatures rise as much as 20° around the perimeter of the building. To compensate for this difference, and satisfy all the tenants, our architects and engineers devised a dual air conditioning setup: a peripheral system cools the sunny side of the building and heats the shadow side, when necessary; an interior system maintains comfortable air conditions in inside offices.

"Selected on the basis of durability, design, and past performance, American Blower air handling and conditioning equipment is a major factor in our dual system," concludes Manager McClung. "American Blower offices in Dallas and New Orleans helped us coordinate delivery between our Texas and Louisiana contractors."

If your plans include air conditioning – for a large-scale central or zone system, or a system for a smaller store, showroom or factory – call our nearest branch office for friendly assistance. American Blower Corporation, Detroit 32, Michigan. In Canada, look for Canadian Sirocco products.

Henry C. Beck Building, Shreveport, La. Owners: Travis-Edwards, Inc., Shreveport; Architects: Neild-Somdal, Shreveport; Consulting Engineers: Reg Taylor and Associates, Houston; General Contractors: Henry C. Beck Construction Co., Dallas; Mech. Contractors: James F. O'Neil Co., Inc., New Orleans.

AMERICAN BLOWER

Division of American-Standard

Air conditioning equipment for every business

Memorial Chapel in the Beck Building, a non-denominational "Place of Prayer and Meditation for All," is air conditioned by American Blower.

Widely varying air conditioning needs of building's shops – a florist (shown), a barber, and a bank—are efficiently handled by American Blower equipment.

Building Supt. C. W. McCormick, American Blower's I. A. Lindberg, and Building Mgr. E. E. McClung worked together during installation of equipment.

How Janitrol
MULTIPLE HEATING UNITS
multiply school building and modernization dollars

MOST ECONOMICAL IN OVER NINETY SCHOOLS is the record of this thoroughly modern Janitrol forced warm air heating system designed by Architects Kistner, Wright & Wright, Los Angeles. Each room has a compact, concealed, Janitrol gas-fired winter conditioner in a ventilated closet. Thus each room enjoys individual temperature control, as required by student activities. Two warm air outlets are placed above the woodwork. Air return is below access door. An outside air inlet supplies combustion air.

Specifying Janitrol gas-fired warm air individual room units in place of a central system can mean savings up to 50% on original equipment and installation. *More* dollars to spend for other phases of construction or modernization, with assurance that the children and teachers will get top quality heating in classrooms, gymnasium, cafeteria.

The versatility of Janitrol gas-fired units makes them easily adaptable for a wide variety of installations. Units operate only as needed—no wasted heat in unoccupied areas. With a Janitrol "multiple unit" installation, you can provide *zoned comfort* without extra cost . . . insure lifetime heating economy.

All requirements are met by Janitrol's complete line. Select from models for closet or alcove, for suspension from ceiling, for vertical or horizontal discharge in a wide range of heating capacities. Every Janitrol gas-fired heating unit features the famous Janitrol Multi-Thermex heat exchanger, with a record of less than ¼ of 1% failures for any cause in over two million exchangers. Your reputation is in good hands when you trust it to Janitrol quality and economy.

ARCHITECTS' AND ENGINEERS' INFORMATION SERVICE

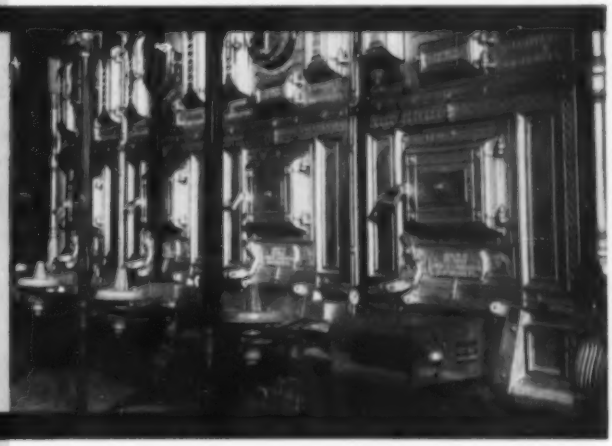
Write today for complete A.I.A. files on heating with gas in big buildings of every type, and for Janitrol specifications service. There's no obligation.

HERE'S A COMPACT, LOW COST INSTALLATION. The Janitrol Winter Conditioner is on a plenum alongside an outside wall and backed up to a partition wall. Warm air is discharged from the top outlet grille across the outside wall and windows. Fresh air and recirculation air enters through the floor plenum. If desired, ducts can be extended through the partition into the adjoining classroom, and both rooms heated by one unit. Installation in Tilley Elementary School, Orange, Texas. Architects, Stone & Pitts, Beaumont.

"WE SAVED ENOUGH TO BUILD WITHIN OUR BUDGET BY USING JANITROL GAS UNIT HEATERS INSTEAD OF A CENTRAL SYSTEM", states Mr. James Dawson, Sup't. of Schools, Crawford County, Bourbon, Mo. Each heater is thermostatically controlled. The architectural firm of Barnes and Snipes writes, "The reason for using Janitrol equipment included economy of installation and flexibility of handling the heating problem." Janitrol Gas Unit Heaters are designed for dual fuel operation, save floor space, reduce maintenance costs.

A TYPE OF INSTALLATION FAVORED BY MANY ARCHITECTS incorporates a Janitrol Horizontal Winter Conditioner suspended from the ceiling in each room. Warm air is directed parallel to outside walls and across glass areas. A built-in centrifugal blower provides quiet, even air circulation. This unit is also approved for use with a duct system, and is available in models for 65,000 to 150,000 Btu/hr. inputs. Installation illustrated is at Rosen Heights School, Fort Worth, Texas. Architect is Stanley Brown, Dallas.

LOUVERED CEILING PANELS of the venetian blind type serve a three-fold need at West Columbia School, near Houston, Texas. They conceal the Janitrol blower-type unit heater. They effectively diffuse the heat, preventing it from blasting on the occupants below. They diffuse and distribute light from the sawtooth roof windows. This type of application is recommended for areas where "cold floor" problems are not encountered. Architect: Donald Barthelane, Houston, Texas. Contractor: The Warren Co., Houston.



MANY SCHOOL-HOUSE TYPE FURNACES HAVE BEEN CONVERTED FROM COAL TO CLEAN, EFFICIENT GAS by installation of Janitrol SC-05 large capacity burners, which are designed for input capacities up to 750,000 Btu/hr. each. The Janitrol SC-05 Conversion Burner fits furnaces or boilers with an ashpit opening not less than 15⅛" wide by 7-5/32" high and in which the depth of the burner throat does not exceed 4". Shown here: Installation at Bridgeport High School, Bridgeport, W. Va.

Janitrol

JANITROL HEATING & AIR CONDITIONING DIVISION
SURFACE COMBUSTION CORPORATION
COLUMBUS 16, OHIO
IN CANADA: MOFFAT HEATING & AIR CONDITIONING DIVISION
MOFFATS, LTD., TORONTO 15

Also Makers of *Surface Industrial Furnaces, Kathabar Humidity Conditioning, Janitrol Residential Heating and Cooling Equipment.*

winter conditioners adaptable for summer cooling

. . . with installation of Janitrol's new air-cooled cooling system that uses no water, eliminates water service and maintenance costs. May be installed concurrently with winter conditioner, or any time later, without additional duct work.

How Bethcon helps you do better sheet-metal work

Here we see part of the complex heating and ventilating system of a large department store in New Jersey. Tons of Bethcon galvanized sheets went into the fabrication of this system and contributed substantially to the quality of the installation.

You can do better sheet-metal work with Bethcon because Bethcon sheets are made by a continuous process of galvanizing, which binds the zinc coating more tightly to the steel than the conventional method. This extra-tight coating permits severe forming without danger of cracking or flaking off.

You will find, in addition, that Bethcon has brighter, more uniform spangles which present a more attractive appearance. And the zinc is distributed more uniformly over the entire sheet, thus eliminating the bead normally found on the drip end.

If you have not yet worked with Bethcon galvanized sheets a chat with someone who has should prove interesting to you. We will be glad to give you the name of such a contractor in your vicinity. And, of course, we are ready at any time to discuss Bethcon with you ourselves. Just call or write to the nearest Bethlehem sales office.

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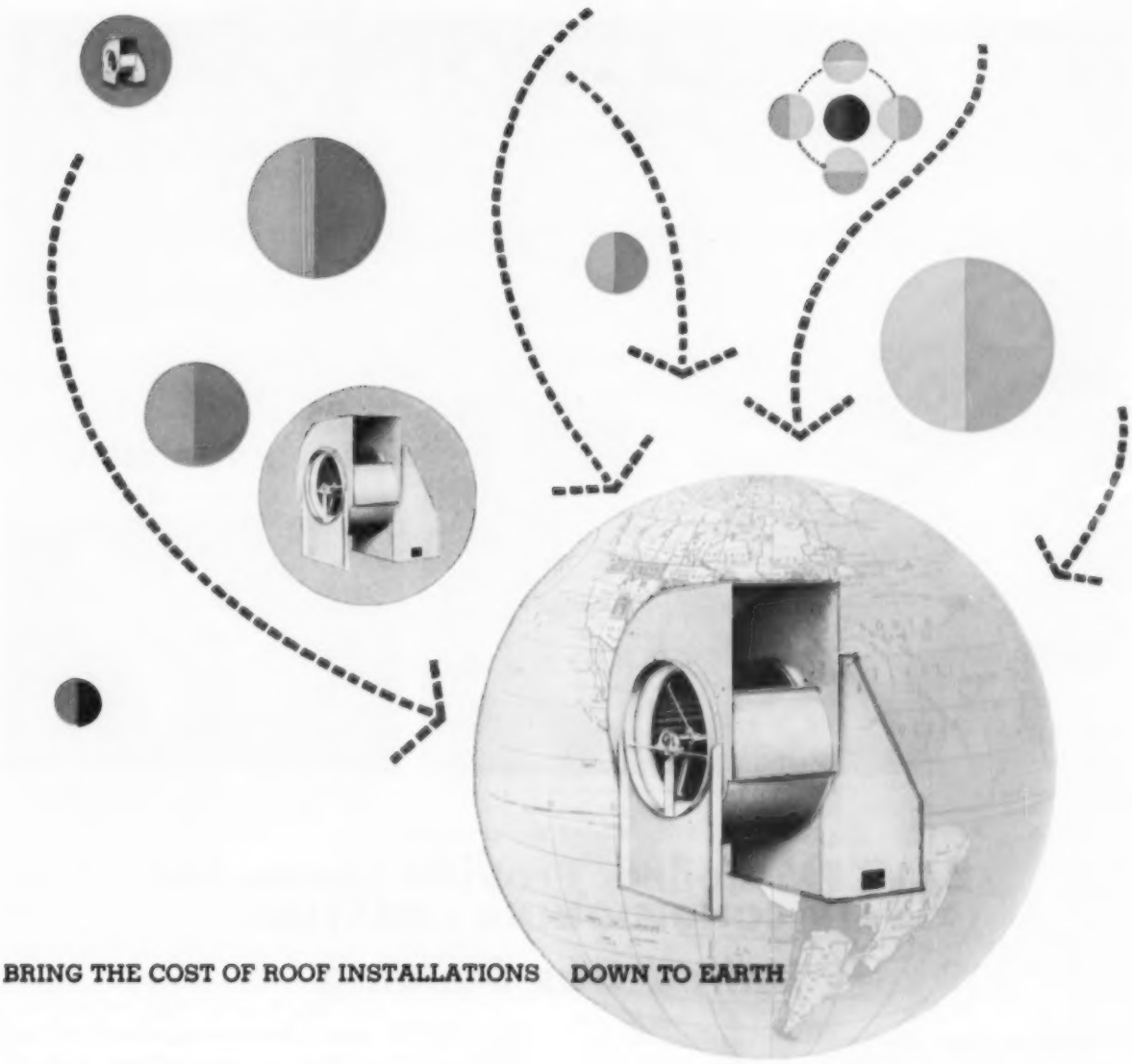

BRING THE COST OF ROOF INSTALLATIONS DOWN TO EARTH

Utility's new blowers with weatherproof enclosures for motors and drives eliminate sky-high roof installation costs and weather-wear. These high-quality units insure a long life and a low amortized cost.

Because a roof installation becomes the "forgotten fan," it frequently breaks down from lubrication neglect. Utility has made sure this can't happen — all sizes feature permanently sealed, pre-greased ball bearings. They're forever impervious to dirt, moisture, and drastic temperature changes and require no further lubrication.

Manufacturers of heavy and standard duty blowers for heating, air conditioning and ventilating installations. Producers of blowers and blower parts for original equipment manufacturers. Write for catalogue data.

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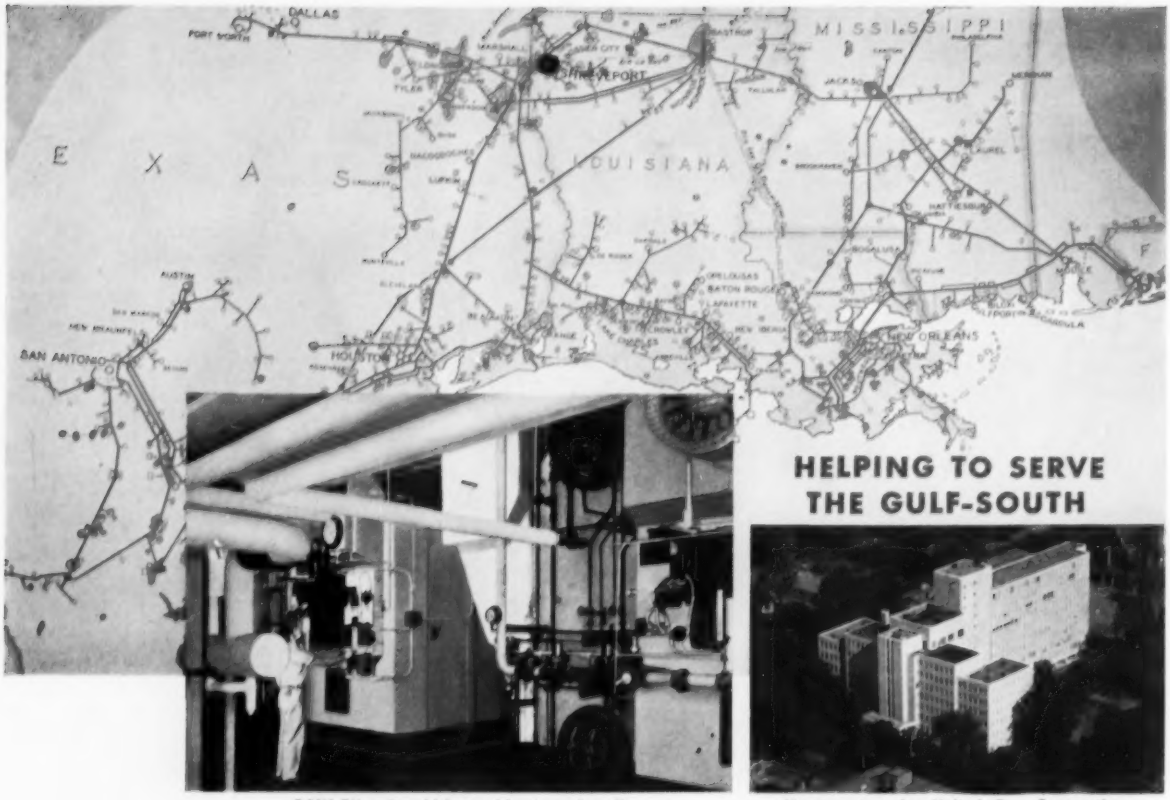

HELPING TO SERVE THE GULF-SOUTH

B&W FM units which provide steam for all requirements in the United Gas Building.

Headquarters for United Gas Corporation, the world's largest handler of natural gas.

B&W FM Boilers Provide Steam for AIR CONDITIONING • HEATING

United Gas Building

United Gas Corporation and its subsidiaries of Shreveport, Louisiana, one of the largest systems of its kind in the world, supplies natural gas to a large and growing part of the southern section of the United States —the "Gulf South". And when the installation of modern heating and air conditioning facilities in the company's Shreveport headquarters building was being studied, the same careful consideration applying to other phases of the company's far flung operations was given to the selection of boilers. As other users have done, United Gas chose two B&W FM Units for a reliable and economical steam source.

In the newly enlarged United Gas Building, the FMs supply the heating load during the winter and steam for the much heavier summertime air-conditioning load. They are gas-fired and designed for manual or semi-automatic operation. Each boiler is designed to generate up to 11,000 lb of steam per hr at an operating pressure of 160 psi. Since their installation in August 1953, the FM Units have provided completely satisfactory service, efficiently and economically.

B&W FM Boilers are available in standard sizes to 40,000 lb of steam per hr at pressures to 235 psi. Many are also in service at higher pressures and with moderate superheat. Write for Bulletin G-76 for complete details. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

G-744

FMs Offer These COST-SAVING FEATURES

- Save Erection Time and Cost
- Meet Wide Range of Service
- Handle Quick Load Changes
- Suitable for Outdoor Service
- Safe, Automatic Operation
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Burn Oil and/or Gas
- Save Fuel
- Save Space

BABCOCK & WILCOX

BOILER DIVISION

Construction Hits New Seasonal High

. . . in eight categories

NEW CONSTRUCTION in July expanded seasonally to $4.2 billion, according to preliminary estimates prepared jointly by the U. S. Depts. of Commerce and Labor. This figure surpasses the previous July high set in 1955.

Total value of construction for the first 7 months of 1956 set a new record of $24.1 billion for the period.

Construction expenditures in July hit a record annual rate of $44.4 billion when adjusted seasonally. This compares with actual outlays of $43.0 billion in 1955.

The two departments noted that in preparing these monthly estimates, they were not able to reflect the effects of shortages of steel and other materials on the volume of work put in place.

Virtually all types of construction contributed to the 5 percent rise from June to July, with outlays for the following eight categories reaching all time monthly highs: private industrial buildings, office buildings and warehouses, social and recreational buildings, public utilities, highway work, public education buildings, sewer and water facilities, and public service enterprises. ⫩

Room Conditioners Gain 50 Percent in Chicago

. . . 60 percent are in offices

SALES of room air conditioners in Chicago are at new record levels this year.

They show signs of extending the last couple of years' 50 percent annual sales gain through 1956, despite the much larger base against which any gain must now be measured.

Commonwealth Edison Co. and its affiliated Public Service Co. estimate that sales of room air conditioners this year will hit the 75,000 mark in their territory. A hot summer could boost the figure substantially above that.

Last year, 57,000 room air conditioners were added, 30,000 in 1954, and 25,000 in 1953.

No figures were available on installations of central air conditioning systems. Commonwealth Edison estimates that over 1000 of these were installed in 1955.

About 60 percent of total room air conditioner installations this year have been in offices. ⫩

Engineering Center Site Seen Remaining in N.Y.

. . . enlarged quarters is goal

THE NATIONAL headquarters site of the Engineering Societies Center will continue to be in New York if the recommendation of a special site committee is acted upon, according to L. S. Dennegar, director of public relations for The American Society of Mechanical Engineers. In addition to the ASME, four other societies will continue to be housed in the center. They are the American Society of Civil Engineers, American Institute of Mining, Metallurgical, and Petroleum Engineers, American Institute of Electrical Engineers, and the American Institute of Chemical Engineers.

Both Pittsburgh and Chicago were previously rejected as sites.

Present New York headquarters are inadequate. Plans for the new and enlarged center include reconstruction of the present building and/or construction of a new building on the same or comparable midtown site. ⫩

Air Filter Institute Revises Test Code

. . . minor changes in Section I

THE Air Filter Institute code for testing air filters, originally adopted by the AFI in 1953, has been recently revised, according to Arthur Nutting, secretary-treasurer.

Substitution of a permanent grounding grid for the absolute filter in place of disposable aluminum foil simplifies testing and reduces cost.

Another change is the substitution of a single report form having curves for resistance and arrestance vs dust load and resistance vs air flow in place of two separate forms.

Copies of AFI Code, Section I, 1956 Revision, and AFI Report Form No. 542 are available at nominal cost by writing to The Secretary, Air Filter Institute, 300 Independence Ave., S.E., Washington 3, D.C. ⫩

Compressor Shipments Up 37 Percent

. . . in first four months

MANUFACTURERS' shipments of compressor bodies used in air conditioning and refrigeration units were up 37 percent during the first four months of 1956, compared with the same period of 1955, according to Geo. S. Jones, Jr., managing director of the Air-Conditioning and Refrigeration Institute. The figures, which do not include compressors used in household refrigerators nor a relatively small number designed for use with ammonia refrigerant, were compiled from reports made to ARI by manufacturers whose output is estimated to represent in excess of 90 percent of the industry, he said.

Actual shipments for the four

month period totaled 1,870,966 units, compared with 1,365,670 units in the same period last year. April shipments this year were 523,227 units, against 399,785 in April 1955.

Of the four month total for 1956, 114,620 of the compressor bodies shipped were of the type used in automotive air conditioning. A comparative figure for four months of 1955 is not available, but total 1955 shipments amounted to 255,371 units.

Figures for compressor bodies 5 hp and above, by categories, are as follows:

Horsepower	Units shipped 1956	
	April	Jan.-April
5	10,090	35,427
7½	4269	15,182
10	1462	4521
15	810	2542
20	295	954
25	216	569
30 and over	761	2456

Engineering Colleges Short 1300 Teachers

. . . for coming year

ENGINEERING COLLEGES of the U. S. have experienced a net loss of 3 percent of their professors to industry within a two year period, according to the American Society for Engineering Education. The engineering colleges need 1300 more teachers to carry the 1956-57 load.

This serious situation was reported to the society by an industry committee headed by A. R. Hellwarth, assistant to the director of employment, The Detroit Edison Co.

The committee, acting under the Relations with Industry Division of the ASEE, reported a net two year loss of three professors in each hundred from campuses to industrial employers, with higher salaries being the major lure. During the two year period, more than 750 left engineering faculties for industry, but 500 left industry for teaching positions.

The 150 colleges and universities accredited by the Engineers' Council for Professional Development covered by the industry committee's survey reported a gain in teaching strength from 8000 to 8400 during the period, in spite of losses to industry.

The 1300 present shortage would require the engagement of 15 additional professors or instructors for every 100 now teaching.

Construction Awards Take Summer Dip

. . . after seven months' high

CONTRACT AWARDS for future construction in the 37 eastern states in July were 5 percent below July of last year, according to the F. W. Dodge Corp. The total of $2,148,559,000 was the second highest ever recorded in July, however, exceeding the third highest July figure by 17 percent.

The cumulative total of awards for the first seven months of 1956 reached a record high of $15,347,518,000, an increase of 8 percent over the same period a year ago.

Awards of $543,308,000 in the heavy engineering category, the highest July in Dodge history, were 29 percent greater than a year ago. In the other major construction categories, nonresidential building at $847,332,000 was 5 percent below July 1955, and residential building at $757,919,000 was 21 percent below the same 1955 period.

Major construction categories set new all time records for the first seven months cumulative totals. Individually they show: nonresidential at $5,455,014,000, up 9 percent; residential at $6,456,587,000, up 1 percent; and heavy engineering at $3,435,917,000, up 22 percent.

Commenting on the current situation, Dr. George Cline Smith, vice president and economist for F. W. Dodge Corp. said:

"Contract awards for June and July were slightly below last year's record totals, marking the first time since mid-1953 that two months in a row have declined. A general tendency for the figures to level off has been apparent in the past few months, but this is not unexpected. In outlook statements published last fall we and other observers took the position that it was unreasonable to expect sharp increases like those recorded in 1955 to continue into this year.

"But it should be emphasized that awards are still at enormously high levels. The current figures are far higher than those for the middle months of any year except 1955. And the totals for the first seven months of this year set a new all time high 8 percent ahead of last year's record.

"Construction activity based on these contract awards will undoubtedly reach new heights this year, with enough emphasis on business and government investments in new facilities to offset a softening in residential building."

Brothers Establish Technical Writing Firm

. . . will specialize in manuals

ESTABLISHMENT of a new technical writing service for producing technical manuals, books, pamphlets, reports, and scientific writing is announced by Kalman Steiner, of Baltimore, a member of HPAC's board of consulting and contributing editors. Associated with him is his brother Joseph A. Steiner, of Chicago.

Known as Steiner Technical Writings, the firm will specialize in preparing technical manuals of instructions for equipment supplied by manufacturers to the government. Their work will include technical and scientific writings in other fields of engineering and technology also.

"Quote"

"The difference between the right word and the almost-right word is the difference between lightning and the lightning bug."—Mark Twain

Top: Home of Alfred A. DiCenso, Williamsport, Pa., where 27 Webster Heating-Cooling Conditioners in eight separate zones comprise completely automatic year-round climate control. Architect: Wagner & Hartman. Heating Contractor: Orrin Roller. General Contractor: William Springman – all of Williamsport.

Center: Webster Heating-Cooling Conditioners, Models C-80 and C-40. Both models available in Free-Standing, Semi-Recessed or Recessed Cabinet types.

Bottom: Library-den in DiCenso residence. Note Webster Conditioners with woodgrain finish beneath windows.

Success Story . . .

Heating and Cooling with Water

This luxurious ranch home, with over 4,000 sq. ft. of living space, uses Webster Heating-Cooling Conditioners to achieve three objectives:

1. Hot water heating . . . to assure complete comfort throughout a 7-month Pennsylvania heating season;
2. Chilled water air conditioning . . . with easy, flexible control of cooling temperatures, room-by-room or zone-by-zone;
3. A central system for both heating and cooling, without expensive ductwork. No window obstruction.

Webster Heating-Cooling Conditioners can also be used for modernization. Simply replace present radiation in existing hot water heating systems, and add central chiller. For the best in all-season living comfort, not only in homes but also in motels, apartments, offices or professional buildings. For more information, see your W bster Representative, or write for Bulletin 2001-A.

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The Nesbitt Little Giant Unit Heater

MOUNTS CLOSER TO THE CEILING

MORE ACCESSIBLE

Two male pipe connections extend from square steel headers on opposite sides of the Little Giant. The motor and fan are removable through outlet at bottom. Therefore, all access is from below; Little Giants mount as close as 1 inch (not more than 3 inches) from ceiling. This means maximum headroom on any type of system.

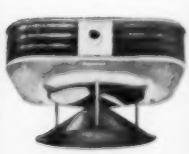
MORE ADAPTABLE

The rectangular wrap-around heating element operates with either steam or hot water, in vertical or horizontal position. The 34 unit models offer capacities ranging from 34,000 to 684,000 Btu per hour—sound rated (IUHA) for the environment they serve — with a wide variety of outlets for air distribution and mounting height as desired. Truly, Little Giants are the "propeller-fan unit heaters with blower-fan performance." See Publication 402. Made and sold by John J. Nesbitt, Inc., Philadelphia 36, Pa.

ADJUSTABLE VANE

VERTICAL LOUVER

HORIZONTAL LOUVER


CONE DEFLECTOR

ANEMOSTAT OUTLET

THE NAME TO GO BUY IN UNIT HEATERS

Nesbitt

"Open for Discussion"

• WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

'Homogenized Heat' Is Misnomer for Jet Principle of Air Distribution

I WOULD LIKE to comment on the item, by Jack Janofsky, titled *Find "Homogenized Heat" System Practical for Commercial, Industrial Space,* in the June HPAC. His use of the term "Homogenized Heat" is in line with the modern day practice of inventing a name for something which is already well known because there is nothing new about the theories which he advocates. He is simply using the jet principle of inducing a motion of the air within the room and mixing with the air of the room, by virtue of the velocity of a small jet of heated air.

This principle is applied in many places, particularly by both steam and gas fired unit heater people, and by package furnace people where high velocity discharge is used to get the mixing effect of the jet driving into the room. I heard Willis Carrier say as long as 25 years ago, that a jet of sufficient velocity could induce motion of the air within the room to as much as five or six times the volume of the jet itself. It works — there's no question about it — but it has limitations.

If the jet is pointed at the floor, as Mr. Janofsky advocates, the volume of the jet must be quite small unless it is in a place where drafts and excessive air motion near the floor will not be objectionable. But in any space where heating is for human comfort, such movements are apt to be objectionable to someone. So, when you come to apply the principle of the jet to larger spaces and with larger capacities and larger volumes, the jet must not be driven toward the floor as a rule. It must be driven horizontally for the best results, in my opinion. Or, it may be driven upward. In either case, it will work if you do enough of it.

The process is not one of homogenizing, however, and the small volume of air which is involved in Mr. Janofsky's conception does not stay at any given temperature. It keeps on mixing until it reaches the level of the temperature of the room at the level of height determined by its weight. As the warm air is driven down and strikes the floor, it tends to warm a spot on the floor. It tends to mix with the air at the floor, at which point it loses a large part of its high velocity, and creates a pool of warmer air — partially heated air, we'll put it — which, being a pool lighter in weight than the other air at that level of the room is forced up immediately by the determination of the colder air to drive in and occupy that space. It does not rise. It is forced up, and it is forced up until it reaches a level at which the other air is not trying to push it out of the way in order to occupy its space. So, what the jet does, used in this way, is simply to start at the floor a gravity movement of air, gradually mixing the heated air which has been driven in with the other air until the mixture is complete, or as he says, "homogenized."

There is another limit to his ideas, I think, due to the fact that he has been operating altogether in a very mild climate where little heat is needed, compared with some sections. If the system he describes is transferred to a colder climate where more actual heat is needed in the room, I would expect to meet objections of too much air motion at the floor.

So, in the large spaces, we reached the conclusion many years ago that the more desirable method is to introduce the air anywhere that you want, but pull off the cold air directly from the floor. There will be less disturbance, and in the case of a large room — particularly an audience room — there will be more comfort at the floor than by the method of driving the jet down to the floor to mix with the air of the room at that point.

E. K. CAMPBELL
Chairman of the Board
E. K. Campbell Co.

THE AUTHOR REPLIES—

THE overhead heater discussed in my comments in the June HPAC has an air delivery of 330 cfm — reported in round figures as 300 cfm — an outlet velocity of 1700 fpm, and discharge free area of 1/5 sq ft. The heated air is projected down 7 or 8 ft to the floor and penetrates the more dense layer of air near the floor by the "jet" effect, loses its bouyancy and much of its velocity, and ends up as a nearly imperceptible thermal current and is no longer dependent on "throw" for its proper diffusion in space. The principal mixing effects occur within a narrow, small zone near the heater, and no discomfort to persons develops when the units are properly positioned in relation to the activity of the occupants. This method of heating has been used successfully in many high industrial buildings, some with ceiling heights of 50 ft or more.

Carrier again makes news

Compact, quiet, complete–

Carrier Hermetic Reciprocating Compressors in sizes up to 60 hp

The big news in compressors again comes from Carrier!

Hermetic reciprocating compressor units of remarkably advanced design are now available for your air conditioning and refrigeration jobs. Carrier introduces two new series—twelve models in all—in sizes from 2 to 60 hp.

They're complete! Compressors and suction-gas-cooled motors form integral units. No motor mounting. No coupling alignment. No equipment room ventilating problems. Water-cooled condensing units come to you completely assembled. Control panels incorporate special-design starters, overload relays, dual pressure switch, oil safety switch and crankcase heater relay. Also a terminal panel that greatly simplifies wiring for fan-coil equipment or cooling tower.

They're quiet! Hermetic design, spring mountings, dynamic balancing of moving parts and special muffler make these units the quietest obtainable.

They're compact! By mounting compressor over the condenser and centralizing all controls, entire unit becomes more compact. It can fit anywhere in a building in very limited space.

They're economical! Units are designed to give top cooling for power input. Compressors 10 hp and up are equipped with automatic capacity control and unloaded starting. Condensers are specially designed to require less water. Control panels utilize special-design starters at a substantial saving.

It's time to call Carrier! Look up the Carrier dealer or branch office listed in the classified telephone directory for complete details and specifications on the new hermetic units. Or write Carrier Corporation, Syracuse, New York.

Carrier

air conditioning
refrigeration
industrial heating

A unit for floor use, available with a slow speed motor, delivers 200 cfm at 1000 fpm and is effective in heating buildings, some with ceiling heights of 35 ft. It has less of the "jet" effect, and while it too is capable of being installed in suspended position 8 ft above floor, it will not produce the equivalent comfort as when installed on the floor.

The average warm air heating system designed with low sidewall registers, with deflecting vanes set for 22 deg downflow and 300 fpm warm air discharge, will accomplish the same in eliminating cold air stratification on the floor, but may cost somewhat more to install, depending on the applications.

JACK JANOFSKY
Kilbury Manufacturing Co.

Some Thermal Efficiency Rating Needed, But Not Proposed Heating Economy Factor

COMMENTING on F. W. Hutchinson's article, *What We Need Is a Thermal Efficiency Rating*, in the March 1955 HPAC, I might agree that some method of efficiency rating might be desirable, but the author's method appears to me only to add confusion to the issue. My reasons for this statement are as follows:

1) The equation $q_s = U_e A_t (t_r - t_o)$ is questionable as related to the author's explanation of the areas and temperature differences envolved. He defines U_e as the equivalent overall coefficient and therefore includes floor, ceiling, walls, inside partitions, and infiltration. Then in order to determine q_s he assumes $(t_r - t_o)$ to be constant for all areas. I believe that we all agree that the inside temperature and outside design temperature cannot be used when determining floor losses, partition walls, losses between unheated and heated spaces, and in many cases when considering ceiling losses.

2) The symbol U_e could be defined, but its practical application can only be used for a constant value of t for all areas involved.

3) The author does not fully explain how U_e can be calculated.

4) The author has established a building standard in that he uses 15 percent of the total wall area to be equal to the glass area. I don't recall that 15 percent is considered a standard. Likewise, total wall area should read gross outside wall area.

5) The use of an illustrative example might have added some clarity to the author's proposal.

6) If a "Heating Economy Factor" were adopted, the values from 1.0 to 10.0 would have to be defined in steps. This would be extremely difficult.

For example: Assume a building in Minneapolis:

Inside design temperature 70 F.
Outside design temperature −20 F.
Dimensions 40 × 25 × 8 ft.
Area 1000 sq ft.

Case 1. Well insulated ceiling, $U_{ce} = 0.10$; poorly insulated outside walls, $U_w = 0.20$; windows without storm sash, $U_g = 1.13$.

$A_t (t_r - t_o)$

Ceiling	1000 × 90 =	90,000
Floor	1000 × 90 =	90,000
Wall, net	714 × 90 =	64,260
Glass, 15 percent	126 × 90 =	11,340
		255,600

Q_s

Ceiling loss	= 1000 × 0.10 × 90	= 9,000
Floor loss	= 1000 × 0.36 × 20	= 7,200
Wall loss	= 714 × 0.20 × 90	= 12,852
Glass loss	= 126 × 1.13 × 90	= 12,814
Infiltration loss	= 0.018 × 1000 × 8 × 90	= 12,960
		54,826

$HEF = 255{,}600/54{,}826 = 4.66$

Case 2. Well insulated ceiling, $U_{ce} = 0.10$; well insulated outside walls, $U_w = 0.10$; windows without storm sash, $U_g = 1.13$.

$A_t (t_r - t_o) = 255{,}600$

Ceiling loss	= 1000 × 0.10 × 90	= 9,000
Floor loss	= 1000 × 0.36 × 20	= 7,200
Wall loss	= 714 × 0.10 × 90	= 6,426
Glass loss	= 126 × 1.13 × 90	= 12,814
Infiltration loss	= 0.018 × 1000 × 8 × 90	= 12,960
		48,400

$HEF = 255{,}600/48{,}400 = 5.28$

Case 3. Well insulated ceiling, $U_{ce} = 0.10$; poorly insulated outside walls, $U_w = 0.20$; windows fitted with storm sash, $U_g = 0.55$.

$A_t (t_r - t_o) = 255{,}600$

Q_s

Ceiling loss	= 1000 × 0.10 × 90	= 9,000
Floor loss	= 1000 × 0.36 × 20	= 7,200
Wall loss	= 714 × 0.20 × 90	= 12,852
Glass loss	= 126 × 0.55 × 90	= 6,237
Infiltration loss	= 0.018 × 1000 × 8 × 90	= 12,960
		48,249

$HEF = 255{,}600/48{,}249 = 5.30$

Case 4. Well insulated ceiling, $U_{ce} = 0.10$; well insulated outside walls, $U_w = 0.10$; windows fitted with storm sash, $U_g = 0.55$.

$A_t (t_r - t_o) = 255{,}600$

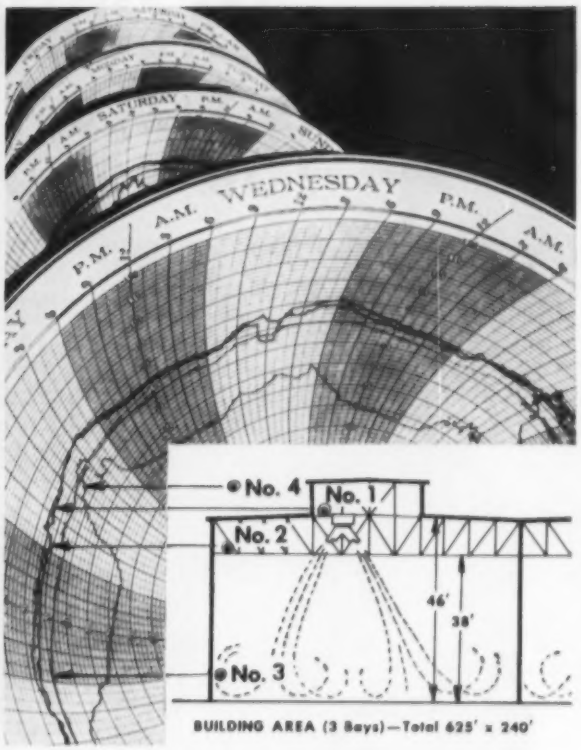
Q_s

Ceiling loss	= 1000 × 0.10 × 90	= 9,000
Floor loss	= 1000 × 0.36 × 20	= 7,200
Wall loss	= 714 × 0.10 × 90	= 6,426
Glass loss	= 126 × 0.55 × 90	= 6,237
Infiltration loss	= 0.018 × 1000 × 8 × 90	= 12,960
		41,823

$HEF = 255{,}600/41{,}823 = 6.11$

On the basis of the *HEF* proposed by Professor Hutchinson, it would be difficult to evaluate these results. Although Case 4 should be the accepted construction for the location under consideration, it is evident from the proposal that all construction would be given approval. Omitting storm sash would be a major error.

A. B. ALGREN
Professor of Mechanical Engineering
University of Minnesota



Recorded Temperature Readings Prove the Heating Efficiency of Wing Revolving Unit Heaters

Effectiveness of Revolving Distributors is shown by Low Temperature Differential between Roof and Working Level

When the Budd Company's new plant in Philadelphia was erected, twelve Wing Revolving Unit Heaters with No. 8 Distributor Outlets were selected to heat the plant.

The complete and uniform heating of this plant proves beyond question the ability of Wing Heaters to project heated air to the working level and that the two-way revolving heat distributors eliminate discomfort of continuous hot blasts of air from heaters having any form of "stationary" distributors.

The Budd Company was interested in knowing the vertical temperature gradient so a series of temperature readings between floor and roof was made. For this a four-point recording thermometer was used.

Recordings made over four weekly periods during February, March and April showed the following averages within the building.

Bulb No. 1 (in monitor)	75.5°F.
Bulb No. 2 (in truss chord)	73°F.
Bulb No. 3 (at working level)	66.5°F.
Bulb No. 4 (outside)	ranged between 20° and 70°F.

In summer: With the heaters operating with steam turned off, the revolving distributors produce a pleasant, cooling effect that keeps workers comfortable and more productive.

Details regarding Wing Revolving Heaters are contained in Bulletin HR-6A. Send for a copy.

Four designs of revolving distributors are available to suit different ceiling heights. Photo above shows Heaters with No. 8 Discharge in high ceiling building. At left heater with No. 5 Discharge for low ceiling is shown.

Wing

REVOLVING HEATERS

L. J. Wing Mfg. Co. 140 Vreeland Mills Road, Linden, N. J.
Factories: Linden, N. J. and Montreal, Can.
In Europe: WANSON, Haren Nord, Brussels, Belgium

WING DRAFT INDUCERS

WING FRESH AIR SUPPLY HEATERS

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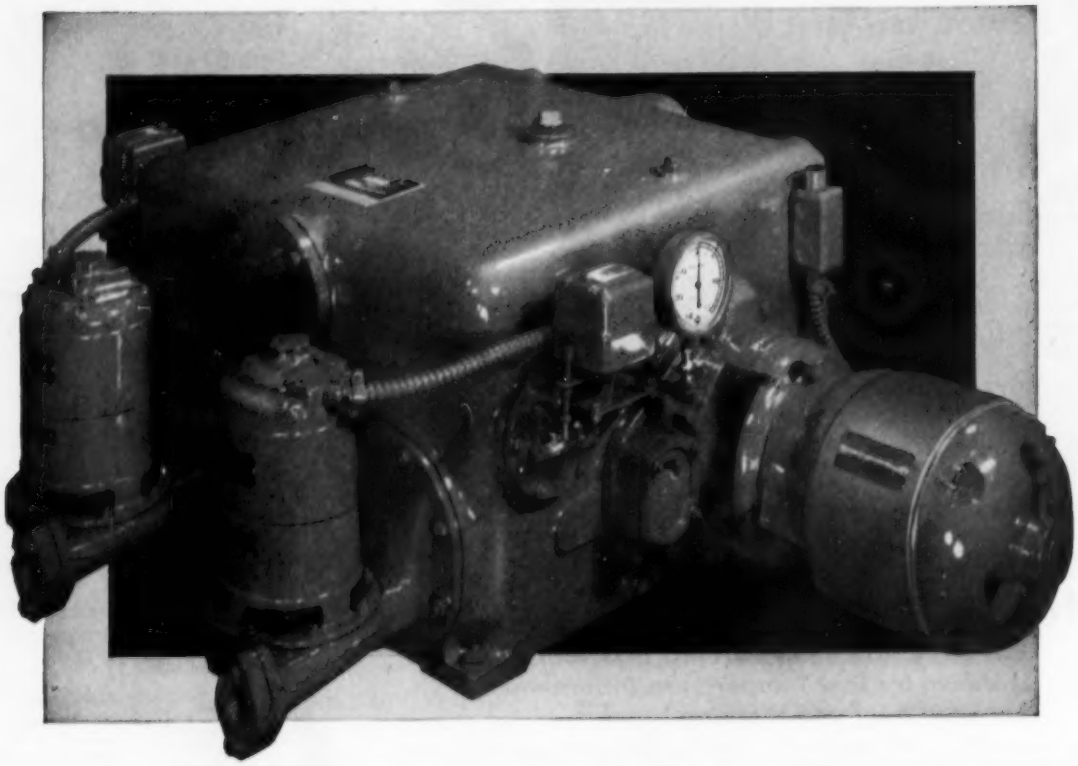
THIS NEW VACUUM HEATING PUMP
IS SIZED TO ACTUAL JOB REQUIREMENTS



It's the Nash CSM

No longer is it necessary for the Engineer to accept a vacuum heating pump with air and water capacities based inflexibly upon square feet of equivalent direct radiation. With the flexible Nash CSM he can provide for proper air capacity in accordance with his judgment and experience. For the individual capacities of the separate pumps on the CSM may be varied within a wide range, without buying an oversize receiver and oversize water pumps.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low, returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

NASH ENGINEERING COMPANY
438 WILSON, SO. NORWALK, CONN.

CURVED ELECTRIC HEATER PIPE is shown being installed at gates of dam on upper Connecticut river in New Hampshire to prevent ice damage

Electricity Heats Viscous Fluids In Diverse Piping Systems

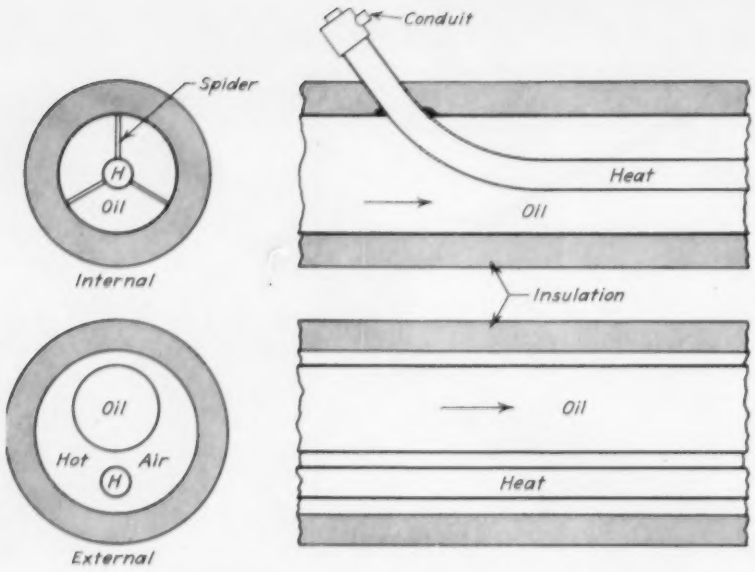
Electrically heated pipe lines are meeting severe demands of industrial service in various applications. Described here are typical examples from the author's experience, including storage tanks for heavy fuel oil, tar, and road oil, tank trucks for paraffin, process equipment for carbon paste and other chemicals, and ice melting systems to protect power dam gates.

By Lee P. Hynes
Consulting Engineer

MODERN TECHNIQUES of handling fluids require carefully designed systems, utilizing pumps, pipe lines, storage tanks, tank cars, tank trucks, marine tankers, barges, and in some cases steel drums and barrels.

Many fluids are either solid or too viscous for flow at ordinary temperatures and require heating to temperatures varying from 100 F to several hundred F, depending on the material. Some of the common materials that require heating are, heavy fuel oils, tar, road oils, pitch, greases, waxes, paraffin, sulfur,

Mr. Hynes is a member of HPAC's board of consulting and contributing editors.



PIPE LINE TRACING by electric heaters in pipe lengths up to 100 ft or more per section is a practical and economical method for many applications

many chemical products, including some plastics, and even fluid metals for heat transfer.

The engineering problems involved are complicated and include a wide range of thermal considerations such as specific heat, latent heat for melting, sensitivity to damage from too concentrated an application of heat, conservation of heat by adequate insulation, and proper automatic controls.

Plan Economic Heating Rate

For large storage tanks, the entire volume of fluid does not always need to be kept warm, but a careful study of the desired draw off rate must be made. The rate of heat application can then be planned at the most economic level.

For pipe lines, the material normally enters at a suitable flow temperature, and enough heat must be applied along the line to balance heat losses, so the temperature will be maintained to the delivery end.

Allowance must also be made for melting out, within some specified number of hours, for a cold line that has stood for some time without being heated.

Reliable and uninterrupted service is so important, and labor costs for operation and maintenance are now so high, that it is a good investment to make a well planned and first class job of any such installation. Too often this is not given the attention that it deserves.

Why Use Electric Heating?

Steam, for a long time the principal heating agent, is satisfactory for many installations where there is a convenient available supply at a suitable temperature. However, there are many situations where electric heating has proved to be more practical and often more economical. Many engineers and executives are beginning to realize that changing conditions have made electricity an important heating agent in this field. This change in thinking is due primarily to the six following factors.

1) Electric power costs have actually been reduced, while the cost of every other heat source has been greatly increased.

2) Labor costs have risen sharply and will continue to do so. Electric heat can be fully automatic and when properly designed requires little if any maintenance or attention. It is the key to automation in fluid heating.

3) New types of heavy duty electric heating have been developed which adequately meet all the requirements for safe, reliable, trouble free service under all the hard conditions that prevail around tanks and pipe lines, indoors, out of doors, or buried in the ground. Even the presence of hazardous atmospheres does not offer any problem for electric heating. Ordinary commercial types of electric heaters are not suited for this hard use.

4) With electric heat there is no problem of draining off condensation, no drain pits or manholes are needed for buried pipe lines, there is no danger of freeze ups, no maintenance of traps or valves, and no possible contamination of fluids by leaks from steam pipes.

5) With steam the temperature depends on the pressure. For the higher temperatures, the pressure would be excessive. For example, at 400 F it would require steam at about 260 psig, and at 500 F over 700 psig.

6) Electric power is more easily distributed by cables than is steam by pipes. Where steam is not readily available from an existing plant, the investment would be considerable to build one. Where heat demands are intermittent, the operation and maintenance of standby boilers, especially in an isolated location, can be expensive. Electric heating avoids the fire hazard of a fuel fired boiler in some dangerous areas.

It is impossible to cover in this article the many details of electric heat applications for so many places where they are useful. Here are just a few typical examples which have been in successful operation for years. They have fully proved the safety, economy, and reliability of electric fluid heating for large and important jobs.

Heat Fuel Oil Tanks in Winter

A group of large outdoor storage tanks for heavy fuel oil, in Northern Quebec, has been successfully heated by electricity for 10 years. They store a winter's supply of fuel for large plants, since navigation is closed by ice. These tanks run up to 150 ft in diameter and are not in-

sulated. A typical tank of this size has a heater rating of 500 kw on 560 volts, three phase.

The heaters consist of 24 pipes, 3 in. I.D., each 63 ft long. These extend through the tank wall, near the bottom. Groups of these pipes are welded through blind flanges which bolt to standard 20 in. pipe necks on the tank wall. A waterproof terminal box encloses each set of heater terminals.

Removable electric heating elements are inserted into the pipes, through the terminal box to heat them.

The heater groups cover a heating area of 25 ft × 60 ft, or 1500 sq ft of area in a horizontal plane. The oil suction pipe connects to the tank on the center line of the heat area and is just above the heater pipe level. This suction pipe extends about 10 ft inside the tank wall, to tap warm oil, away from the cooler wall area.

It has been found that an efficient insulation of the tank walls is provided by a thick layer of congealed oil that adheres to the inside of the tank wall. The colder the weather, the thicker this insulating jacket becomes.

Under automatic control, a pool of warm oil at about 110 F is maintained in the heater area. Then the pumps draw off fuel as needed for the plant boilers. The installed capacity of electric power is computed to meet the maximum desired daily draw off demand.

As warm oil is drawn off from the bottom of the tank, the thick cool oil gradually settles down to the heating zone where it is raised to the proper pumping temperature.

Internal Tracer Heats Oil Line

Another large fuel oil installation, in the Detroit area, has two large oil storage tanks electrically heated and a 6 in. underground insulated delivery pipe line 1000 ft long.

This pipe line has an internal electrically heated tracer pipe, and warm oil is delivered to a group of underground day storage tanks. These are also electrically heated and supply warm fuel oil to the plant boilers.

Preheat Oil for Atomizing

A large plant in the Chicago area has fuel fired rotary kilns for calcining powdered coke. In winter they burn oil but in summer get surplus gas from a neighboring coke plant.

For winter use a steam boiler house was formerly maintained just to supply steam for heating the storage tank, the pipe lines, and for preheating the oil to an atomizing temperature of 180 F for the kiln burners. This steam plant was getting old and needed replacement. The labor problem was also critical because of the temporary crew needed only in winter.

After a thorough study, an automatic electric heating system was adopted, with satisfactory results in labor saving and overall costs. The old boiler house was dismantled.

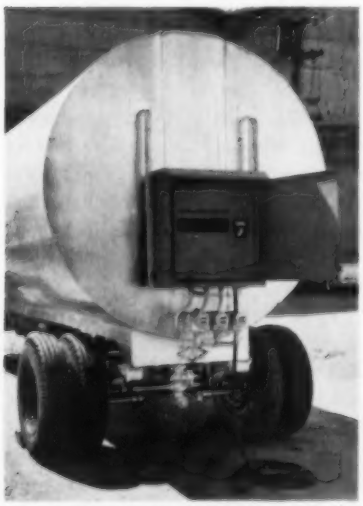
After several years' operating experience with electric heating, this same method was installed in another of their western plants with the same profitable results.

Heat Road Oil in High Tanks

Road oil stored at remote rural locations for making repairs to pavements must be handled hot. Because it has proved too expensive to maintain individual steam boilers and operate steam heating systems at these local storage stations, several hundred such stations in many states have been converted to automatic electric heating within the last 10 years. The results have been so satisfactory in reducing overall cost of operation that the practice is now practically the standard method for such stations.

A typical station consists of one or more large horizontal storage tanks 10 ft in diameter × 28 or 30 ft long. These are elevated on concrete supports and are insulated and covered with aluminum sheets.

These storage tanks are heated to



ELECTRICALLY HEATED TANK TRUCK is insulated, aluminum sheathed

AUTOMATICALLY HEATED, road oil storage tanks have been converted to electric heating by the hundreds in the last 10 years

about 120 F and are maintained at that temperature. A service tank is at a lower level so that the warm material will flow down to it by gravity. The service tank is maintained at about 200 F. Trucks drive under it and can be loaded by gravity flow in a few minutes.

Mix Hot Tar, Oil, Aggregates

Many road departments and private contractors operate mixing plants where hot tar or road oil is mixed with aggregates into the final road material which is distributed by dump trucks to paving jobs.

Many such plants have abandoned the old method of fuel firing and have gone to modern electric heating of their storage tanks, melt tanks, pipe lines, and pug mills. The results have been very satisfactory in overall costs and in safety from fire hazards.

Prevent Paraffin Chilling

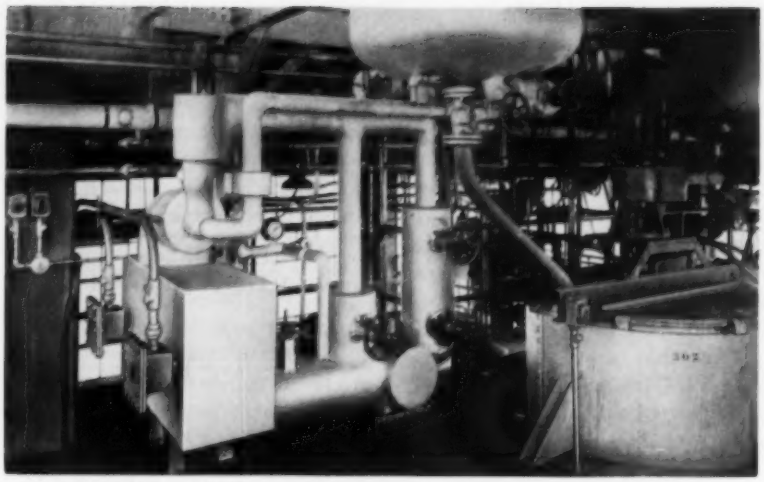
Frequently, heavy fluids and compounds such as paraffin, etc., are delivered hot by tank trucks. Being well insulated, they hold heat sufficiently for several hours of driving time. When laid up in garages or outdoor yards over weekends or even overnight in severe winter weather, heat is necessary to prevent chilling below the flow point of the material.

Such tanks are sometimes equipped with electric heating pipes and automatic temperature control. A heavy cable and plug permit connection to a suitable power supply at layover points. It is also feasible to install diesel driven generators on such trucks and do electric heating in transit when this is necessary for special long runs in very cold areas.

Keep Process Equipment Hot

A plant producing over 200 tons per day of carbon paste lining material for electrical pots, used in reducing aluminum ore, installed electric heating for this job.

All the tar and pitch are melted and raised in temperature in large outdoor insulated tanks. The pipe lines, superheaters and the large rotary mixers which blend the hot fluids with powdered coke are also heated electrically.



INDIRECTLY HEATED AUTOCLAVES in a hazardous atmosphere utilize heat transfer oil, which is circulated between jackets and equipment

The temperatures required are too high for steam at any reasonable pressure. Also, the automatic features of electric heat are an added advantage, as different parts of the system required different temperatures.

After several years of satisfactory experience, large additions are now being made with this same system of electric heating. No troubles or shutdowns have been experienced, and much labor has been eliminated over any type of fuel firing.

Use Heat Transfer Fluid

In the manufacture of greases, chemical compounds, etc., many autoclaves, kettles, and other process equipment are heated by an indirect method of applying electric heat. Special heat transfer fluid, usually a very stable type of nondecomposing oil, is pumped at high velocity through special electrically heated passages and through vessel jackets.

Temperatures up to 600 F or more are easily maintained with only a low pumping pressure. This electric equipment can be made entirely safe for local installation close to the vessels, regardless of the presence of a hazardous atmosphere, which often exists or may exist in the area. Fuel firing here would be impossible.

These are just a few of many illustrations that could be cited where electric heating has been successfully engineered into major industrial process equipment for the handling of viscous fluids.

Protect Power Dam Gates

Water is not usually thought of as a highly viscous fluid, but in various stages of freezing it can be slush, snow, or solid ice.

Much work has been done in melting ice from large power dams in cold areas in the U.S. and Canada by electric heat. This is done by installing electrically heated pipes such as have been described for tanks and pipe lines. To cite one instance, the great power dams being constructed on the St. Lawrence river are using about 50,000 ft of this type of electrically heated 3 in. pipe to protect the gates from ice damage. No service could be more severe than this, where heaters are out of doors and submerged in the icy waters of a turbulent river.

They were chosen for this project because no other method of heating had the same long and successful record of successful performance under similar conditions.

Electric heaters can meet the most exacting industrial service if engineering based on real experience enters into their design. ⧺

Sam Lewis' Page

Analyze Heat Transfer Problems For Correct Converter Tube Design

. . . to reduce maintenance and guard against failure that would result from mineral scale, leaking, clogged tubes, and inadequate provision for expansion

OCCASIONALLY an argument arises over what type of steam-to-water converter should be specified. There is even some variation of nomenclature and spelling. A senator is not a senater, but, perhaps seeking individuality, some manufacturers prefer to spell the heat transfer device, convertor.

An early small hot water heater may have been a metal pot with a fire under it. Grandmother called it a teakettle. The bottom of this pot frequently became covered with flat layers of nonorganic material that we called scale.

SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems.

It had been precipitated, by influence of heat, from its original, invisible, dissolved condition in the water. This mineral stone-like accumulation did reduce the rate of heat transfer through the bottom of the kettle, and eventually the bottom would leak.

When greater volumes of hot water became demanded — as is frequent in large buildings — metal tubes through which water is invited to circulate, were exposed to the fire.

The same old mineral scale persists in being precipitated. As a result, the interior of the tubes eventually acquires layer after layer of scale and eventually may become so obstructed by foreign accumulations that enough water cannot flow to cool the metal of the tube.

The uncooled metal then succumbs to the heat of the fire and the fire becomes doused by the leaking water.

A temporary solution for burned clogged tubes is to heat the water by steam rather than by direct exposure to fire. The steam, less potent than direct fire, does not melt the tubes.

One short tube, however, does not heat enough water; so many tubes are required. The tube ends may be expanded in holes in water distributing headers at the ends of the tubes.

Tubes held rigidly at both ends do not all expand at the same rate when responding to temperature, and the cooler tubes in a "bundle" may leak, even though one end of the bundle may have a floating head.

Another answer is to place the two headers side by side so that each tube becomes U shaped, permitting the unequal rates of length expansion to be absorbed in the spring-like U bend.

Copper is a metal especially well adapted for the tubes in converters.

There are many variations in the physical structures of converters. There are also myriad uses for these devices, as for chilling water for air conditioning and for sterilizing milk.

In some cases, the liquid to be heated or cooled flows inside the tubes, while the substance touching the outside of the tubes at a different temperature, warmer or cooler, may be a gas or a liquid.

If the water to be heated by steam has scale making components, it may be wise to have the steam in the tubes and water around the outside. This way, when cleaning time arrives, the scale may more easily be removed than when it is inside the tubes. ≠

Double Duty Well Water Cuts Cooling Costs in 'Air Tight' Office Building

Mechanical and structural features are integrated in Minneapolis' pioneer multistory curtain wall office building to gain ideal worker environment and low maintenance and operating costs.

By John E. Starrett
Partner, Perkins & Will
Architects-Engineers

DOUBLE GLAZED, CURTAIN WALL STRUCTURE is $2½ million home office of Lutheran Brotherhood, in Minneapolis. Auxiliary finned radiation helps heat basement level

CAREFUL co-ordination of architectural, structural, and mechanical planning has contributed to an optimum working environment for home office employees of the Lutheran Brotherhood, a fraternal life insurance and benevolent organization. Quality materials and mechanical equipment were employed throughout to minimize maintenance and operating costs, and reduce depreciation over the life of the building.

The integrated design of the building and its mechanical equipment has resulted in a number of interesting features. Among them:

1) A 50 percent drop in employee absenteeism during the first few months since the building was occupied, early this year. The owner has credited this increase in efficiency to the effective total working environment aided by complete air conditioning, including electrostatic filtering and "reheat" humidity control, and careful attention to acoustics, illumination, color co-ordination, and psychological spaciousness.

2) Double duty use of the abundantly available 50 F well water in precooling coils in all supply, central zone, and public zone air conditioning units. The 64 F return water from the well water precooling coils is re-used in the condenser of the 172 ton multistage centrifugal water chiller. The 54 F return water from chilled water coils is re-used in the evaporator. The economy of this arrangement has been demonstrated by minimum operation of the chiller during the relatively mild summer just past.

One drawback has been the problem of maintaining automatically the low relative humidity desired for punch card tabulating and accounting equipment on mild but humid days, when the temperature controls do not call for chiller operation. This has been remedied by minor adjustments in the humidity control setting.

3) Virtual absence of condensation, infiltration, and exfiltration. This is due to the air tight design of the prefabricated porcelain enamel curtain walls, backed up with rigid glass insulation, and glazed throughout with fixed double pane sash, with a heat absorbent outer pane.

Exposed mullions and rails, fabricated from stainless steel, were snapped into place, "breathing" outdoor air to minimize condensation. Both the curtain wall sections and mullions were erected in a modified "ship lap" fashion, so that condensation or wind blown rain would drain outboard. There are no exposed bolts or rivets on the entire face of the building, except anchor bolts at the bottom of each mullion protected by the second floor overhang. The cold feeling that is common to metal interior mullions and window frames and sash is eliminated.

"STEAMBOAT DECK" OUTER CORRIDORS on upper floors serve as inside sunshades. 640 double paned insulating plate glass fixed windows are set into curtain wall structure from inside. Tinted outer pane absorbs heat. Perimeter air conditioning units are housed in modular cabinets

4) Reduction of general cleaning and air filter maintenance by filtering all outside and return air passing in series through a combination of dry type electrostatic filters and automatic, renewable roll type filters. The latter filters carry approximately a six months' supply of a variable density glass fiber on large spools. A differential pressure drop switch, set to maintain a constant

INTERIOR ZONE ducts are concealed by furred down corridor ceilings, which give 3-D effect viewed through glass partitions

static pressure drop across the filter determines both the frequency of change and the amount of clean filter exposed. The semi-annual filter change is even semi-automatic. A vane operated switch lights a signal at the filter and on the general control panel whenever the flow of air is impeded by a tail end "leader" of kraft paper at the center of the feed spool.

5) Provision for a gallery control room office for the operating engineer which includes a window overlooking the main equipment room, a master panel grouping all pneumatic temperature controls, and a 24 point potentiometer giving pushbutton temperature readings from thermocouples placed in the various zones.

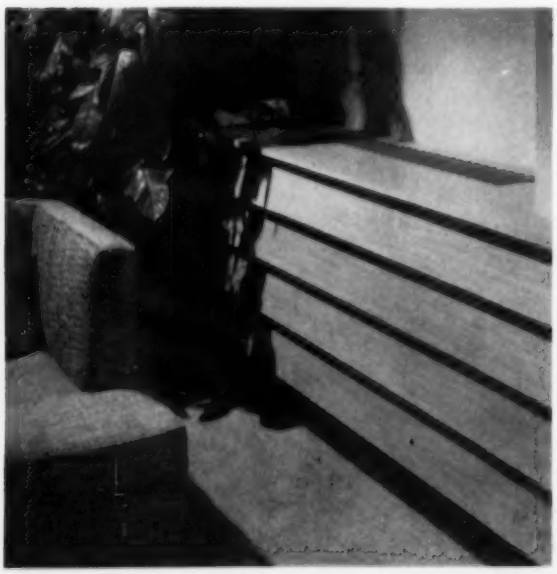
6) Concentration of all vertical mechanical services in two mechanical core towers emerging as penthouses. The principal tower is exposed at street level, and creates a feeling that the building floats around the two towers. The core tower design contributes to freeing maximum clear through spaces for general offices that receive daylight from all exposures.

High Pressure Air Conditions Perimeter Zones

Air conditioning for the building is divided into five general systems serving 20 individually controlled zones in addition to the boiler room ventilating system.

Exterior exposed zones of the six story general office wing and the single story local services wing are conditioned by high pressure, induced air introduced into the rooms through conditioners in the rooms. Both the shop fabricated sheet metal face plates and the plastic counter tops are continuous around the perimeter of the five upper floors, as are the windows. In the library and conference rooms on the first floor the room conditioners are concealed in ship lap louvered hardwood cabinets.

Primary air for the perimeter units is distributed through 12 in. suspended tubular ducts, with 4 in. branches serving each unit. Supply and return chilled water and drainage for the drip pans are grouped with the branch ducts in slots formed in the original concrete structural work. The primary air capacity for the north perimeter zone is 12,407 cfm; the south, 17,458 cfm; a total of 29,865 cfm.



PERIMETER UNITS in ship lap oak cabinetwork condition library. Return air is drawn into high pressure duct unit through air spaces between horizontal boards. Tempered air is discharged through diffuser at top

Cooling capacity of the individual perimeter units ranges from 4310 Btu per hr to 11,335 Btu per hr. The largest size is rated at 5175 Btu per hr for primary air at 56 F and 6160 Btu per hr from the secondary coil, with 57 F entering water. The same unit is rated at 29,350 Btu per hr heating capacity with 180 F water and fan operating, and 5990 Btu per hr heating capacity under gravity — convector — operation.

Individual room units in private offices are controlled by pneumatically operated throttling valves on the supply connection of the secondary cooling coils. The valves are controlled by individual return air stream thermostats, except in general office areas, where up to three units may be controlled by a single return air stream thermostat.

The central supply unit for the perimeter zones (A-1 and A-2) is located in the subbasement equipment room, along with the supply unit for each of the 15 central zones. The central supply units each include the electrostatic and automatic disposable glass fiber filters, well water precooling coils, chilled water cooling coils, steam heating coils, and high pressure supply type fans, mounted on concrete pads with vibration isolators.

The supply unit has modulating outdoor air and return air dampers that permit adjustment from zero to 100 percent outdoor air. A thermostat at the inlet limits the temperature entering the units to 40 F. The provision for 100 percent outdoor air permits substantial operating economies when the combination of solar, lighting, and occupancy heat gains calls for cooling in the outdoor temperature range from 40 to 74 F.

The well water precooling coils are cleanable and sized for an entering temperature of 50 F and a leaving temperature of 62 F at 84 F design temperature. The chilled water coils are designed for an entering temperature of 42 F and a leaving temperature of 54 F. The leaving well water is re-used in the condenser of the refrigeration unit. The return chilled water is recirculated in the evaporator. The units also include tempering and reheat coils with face and by pass dampers.

266 SEAT AUDITORIUM, on basement court level, receives conditioned air through ceiling diffusers. Glass wall, right, opens through lounge to garden court

Built-up Units Condition 15 Interior Zones

A similar built-up unit conditions supply air for all 15 interior zones, including the three court level zones.

Built-up air conditioning units ranging in capacity from 630 cfm to 3870 cfm condition air for the 15 interior zones. Each of these includes a well water precooling coil in addition to the chilling and reheat coils. A constant dewpoint is maintained by a three way valve on the return side, controlled from a thermostat in the fan discharge.

Individually controlled, manufactured air conditioning units, with cooling coils added, condition air for three public zones on the basement or court level. These include the dining room, the public lounge, and the meeting room and platform. The units are in the west subbasement equipment room, underneath the single local story services wing.

The unusual air tightness of the curtain wall necessitated provisions for maintaining a slight positive pressure within the building. This is accomplished by modulating type opposed dampers and an exhaust hood at the top of the return air shaft. The dampers are controlled from a pneumatic static pressure regulator in the return air intake on the third floor with an atmospheric tap outdoors, and serve to maintain a constant static pressure differential. Interestingly, it was virtually impossible to close the exterior doors before the static pressure control system was adjusted.

The heat transmission through the porcelain enamel curtain wall was figured conservatively, using the value of 1 in. of rigid glass insulation, to obtain a U factor of 0.24. This value compares with a U factor of 0.35 for 12. in. of masonry. The heat resistant outer pane on the double window accounts for a 29 percent reduction in the heat gain transmitted through the windows, compared with a normal double window on the south exposure. Also taken into consideration were such factors as the draperies, and the intended "steamboat" corridor construction, which in owner-occupied sections of the building tends to reduce the sun's radiant heat absorbed by occupants, furniture, structure, etc. Tenant floors — fifth and sixth — have conventional partitions.

The air conditioning system is designed to produce from eight to 10 air changes per hr on 25 percent outdoor air operation. The high pressure supply fans operate on a 10 to 12 in. static pressure differential. Vibration isolators are used to minimize the noise level.

The well water supply system has a capacity of 750 gal of 50 F water per minute. It has a 100 hp pump and a chemical treatment system.

The boiler is gas fired, with a standby oil burner. The boiler room is pressurized to assure adequate combustion air by means of a separate ventilating system. Both the boiler room and the main equipment room have escape hatches to the street level.

Both of the main public entrances to the building have radiant coil snow melting systems including a convertor, circulating pump, and coils.

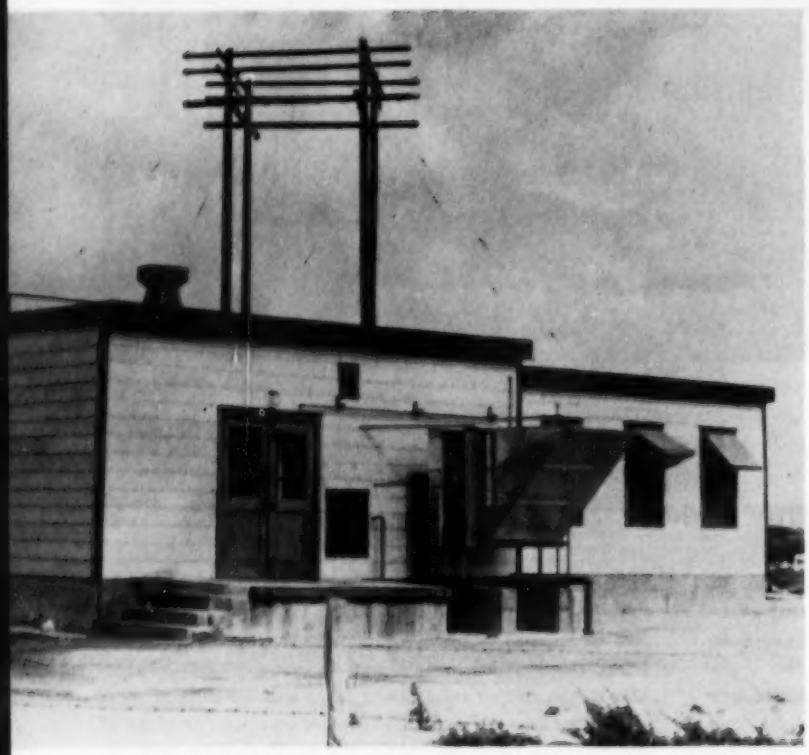
An exceptionally large incinerator was built on the court floor, to dispose of old applications, and other outdated confidential records.

Emergency operation of the subbasement sump pump is assured by a standby diesel electric generator.

The mechanical (heating, piping, and air conditioning) engineers were E. R. Gritschke & Associates. ⧺

How, When, and Where to Use

AIR COOLED CONDENSERS



Factors in the increasing use of air cooled condensers with packaged air conditioners for large as well as small installations are weighed in this article. The author reviews design developments and outlines some of the problems and solutions of installing, controlling, and operating air cooled condensers.

By Warren Viessman

Chief, Mechanical Branch
Installations Directorate
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1 WINDSHIELD serves as protecting wall against which air is discharged from air cooled condenser serving air conditioning system on an island. No ground water and insufficient rain water made air cooled condenser a necessity

AIR COOLED CONDENSERS for air conditioning and refrigeration are being used more and more, with many applications to installations of 100 tons or more. Yet, except for manufacturer's literature, very little has been written concerning their design and application.

What has been written is usually in the vein that they are seldom used for capacities above 3 tons unless an adequate water supply is extremely difficult to obtain. Another statement made is that even for fractional tonnage installations, air is used as the condensing medium only where water is expensive, or where the simplicity of installation warrants the higher condensing pressure and power costs. These two statements, from sources that enjoy considerable prestige, indicate the limited acceptance that has generally been accorded this type of equipment.

Specially prepared for HPAC, this article is an expansion of a paper presented by the author at the Air Force Refrigeration and Air Conditioning Conference held last month at Maxwell Air Force Base, Montgomery, Ala.

However, the fact that air cooled condensers are successfully serving many sizable installations today calls for a new look at the factors influencing their specification. This article briefly reviews design developments and outlines problems — and solutions — of the installation, control, and operation of this type of condensing equipment.

Air cooled condensing units, including compressor, condenser and receiver are standard catalog items with most manufacturers of compressors up to 3 tons. Since the units usually are on the floor and pick up considerable dust or foreign materials, they have a high fouling rate. When located inside, the air circulated is often higher in temperature than the outside air. For the usual full length evaporators on condensing units, the fan does not cover the full length of the coils. These limiting factors of design and application restrict its performance and result in high temperature differences between the temperature of the refrigerant leaving the condenser and the entering air temperature. This may be as high as 40

F as frequently quoted. On many installations of this type, the air condensers have to be augmented with water cooled condensers to carry full load in hot weather.

On the fractional tonnage window conditioners, air cooled condensers have become standard equipment. The greater success of air cooled condensers on this equipment is due to more effective coil coverage by the fan and to a cleaner location. On complete small building air conditioning, separate air cooled condensers have become quite popular lately.

These small commercial applications range in size from fractional to perhaps 3, 5, or 7 tons. However, in the larger commercial and industrial field, many successful applications of air cooled condensers have been made, running into hundreds of tons per plant site.

When to Use Air Cooled Condensers

What are the factors that influence increased use of air cooled condensers in industry for installations of 10 tons or more? Their use and popularity have developed for installations where one or more of the following conditions exist:

- No water.
- Bad water.
- A maintenance problem.
- High water cost.
- Water restrictions.
- Winter freezing problems.
- Winter head pressure problems.
- Weight and erection problems.
- No drainage facilities.
- High sewer tax.

The influence of these items on the selection and use of air cooled condensers is apparent. In most instances some means of water conservation is a necessity. Where sufficient water of acceptable quality is available, an economic comparison should be made to determine the advisability of using cooling towers, evaporative condensers, or air cooled condensers. This should include, in addition to operating and maintenance costs, amortization of the investment and interest. Where there is no water available, or where the water is of such quality as to cause excessive deterioration and maintenance of the equipment, air cooled condensers provide the only solution. This condition prevails in many localities.

Solve No Water and Bad Water Problems

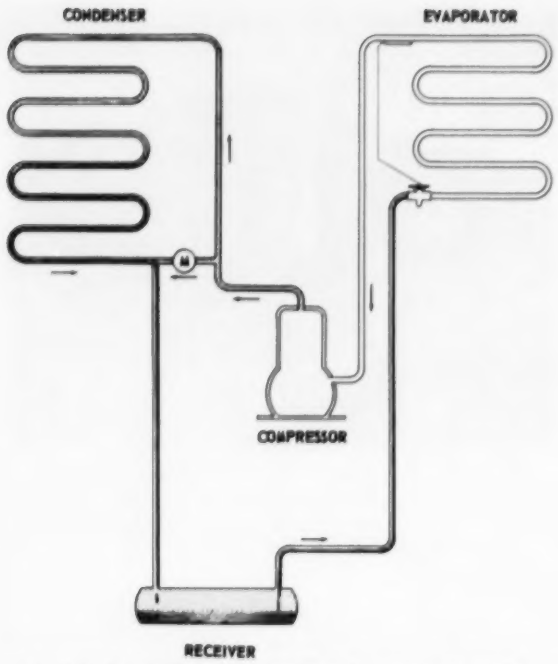
At an island location, air conditioning was required for several buildings. No fresh water was available from ground sources. A catch basin and storage tanks were installed to collect rain water, and the air conditioning equipment was provided with evaporative condensers. Sufficient water did not materialize to operate the equipment. In fact, the evaporative condensers were never put in use after installation but were replaced with air cooled condensers. These air cooled condensers have given very satisfactory results with a 90 F air temperature.

2 ROOF MOUNTED, these air cooled condensers serve 100 ton system in a cafeteria on Florida's Atlantic Coast. Problems overcome here were scale forming and corrosive water and salt

One continental installation on the ocean front has as its water source artesian wells. This installation has over 1800 tons of refrigeration in units up to 100 tons each. This water is below acceptable Government standards of 250 ppm of chloride for potability, but is used for that purpose. For air conditioning use, it is scale forming and corrosive. Chemical treatment and softening is of assistance in reducing the scale forming properties, but the salt and corrosive properties remain. The air also contains salt water particles. Cleaning of condensers and finned coils of scale and fouling matter is an exceedingly difficult and expensive problem.

To meet this problem, air cooled condensers serve air conditioning installations up to 40 tons per building. For larger tonnages, heart redwood cooling towers are

3 COIL VIEW of this 90 ton installation shows automatic dampers on two lower banks, right, to control head pressure. In units on left, head pressure is controlled according to the condenser flooding principle



4 HEAD PRESSURE is maintained in some air cooled condensers by the use of a modulating valve on the hot gas line. Valve causes condenser to flood

used. The design dry bulb air temperature is 93 F. No complaints with air cooled condensers have been received. It was thought that the salt sea air would have a deteriorating effect on the aluminum fins of the coils, but no deterioration has been detected.

Suggests Code for Continued Improvement

Considerable development has been done during the past few years on air cooled condensers. The casing and fins are usually of aluminum or other corrosion resistant material. Coils are usually copper. Fan motors are drip proof and are within the casing between the coil and the fan, out of the weather.

Some fans are propeller type and others are centrifugal type. Larger units are more often propeller type and the smaller units, centrifugal. Air cooled condensers are now available from a number of sources. Improvements have been made in coils and fans, so that installations are reasonably quiet and require a minimum of power. One to 3 ton units are usually direct drive if of the propeller type, and belt driven for higher capacities. Fan speeds range from about 1700 rpm for ¾ tons to 430 rpm for 45 tons. Units above 30 tons usually have two 48 in. propeller fans driven from one or two motors. The motors are designed for the fan loads to which they are applied.

The development of air cooled condensers has been carried on by the individual efforts of the various manufacturers without the benefit of trade association or engineering society codes. This has resulted in a variation in quality and performance of the equipment and a divergence of opinion concerning many of the design parameters. It is necessary for the purchaser to evaluate the equipment on the market in order to make the best selection. In my opinion, a trade association or society code should be developed to standardize on the following parameters:

- Cfm of condenser air per ton of air conditioning.
- Air face velocity.
- Actual square feet of coil surface per ton.
- Design condensing temperature for a given air temperature.

The maximum capacities available from manufacturers vary. Some make units up to 10 tons, others to 40 tons. Larger capacities are obtained by banking units. These units condense flourinated hydrocarbon refrigerant No. 12 for 100 tons of air conditioning. Design air temperature is 95 F. Effective cooling is maintained, even though outside temperatures go above 100 F. Additional air cooled condensers are in the basement for 62½ tons of refrigeration for storage rooms and display cases. For this installation, short duct connections are provided for air intake and discharge.

The condenser must carry away not only the heat absorbed by the refrigerant in the evaporator—the refrigeration load—but also the heat added during the compression process. This is theoretically 42.4 Btu per min per hp. Most catalog ratings are on the basis of the evaporative or refrigeration load, but the design provides for the additional compressor load.

Head Pressure Depends on Design and Service

One principal objection offered to air cooled condensers is that they operate with higher head pressures, restricting tonnage and increasing power requirements. This is somewhat a matter of design and service conditions and is more apt to be erroneous than true. This statement is made based on experience with air cooled condensers and other systems for refrigerant No. 12. Other refrigerants possibly could present results at variance with this.

Air cooled condensers are usually designed for a 110 F condensing temperature. With this design condition, the head pressure of refrigerant No. 12 would be 136 psig. The unit is selected for the desired suction temperature and for the temperature difference to be maintained between the 110 F condensing temperature and the entering air design temperature. Throughout the continental U. S., this ranges from 15 to 30 F. The Seattle temperature difference would be 30 F; Pensacola, 20 F, and Phoenix, 15 F.

There are only a few days each year when the design dry bulb temperature, upon which this depends, is exceeded for a locality. When this occurs, it is only for a portion of a day. During the time when the air temperature is higher than the design value, the condensing temperature will tend to rise above the design point, degree

for degree, the temperature difference being maintained.

For a given head pressure, the capacity of the compressor will drop approximately 3½ percent for a rise of 5 F in condensing temperature. Since the refrigeration peak load lags the sun load by about 3 hours, occurring later in the day when the air has begun to cool off in most cases, and with a probable change in electrical and population loads, this difference is usually of no consequence, and its effects are seldom noticed if the compressor is of ample size. Since these condensers are on roofs and in protected places away from the floor, the fouling factor from dirt and debris is negligible. Also, direct sunlight has no effect on condenser capacity, as the frontal area is so small, the radiant effect of sunlight is negligible compared with the total load handled.

Solve Problems of Winter Operation

Several problems encountered during winter operation under low outside temperatures are common to both air cooled and evaporative condensers. They are:

a) Maintenance of satisfactory operating head pressures during low outside temperature.

b) Failure to start when the compressor motor is pressure actuated and when the ambient temperature around the condenser is at or below the refrigerated space temperature.

c) When a hot gas defrost system is used, quick defrosting depends largely on a sufficiently high head pressure. Low entering air temperatures in winter may cause the head pressure to drop to an objectionable low level, sometimes causing sharply reduced expansion valve capacity by reduction of liquid pressure available at the entrance of the expansion valve. Low head pressures may cause incomplete defrosting with a hot gas defrost system.

To provide a desirable head pressure for cold weather operation, multifan or multifan coil units, or automatic sectional dampers have been used with a control system cutting out fans or regulating dampers to maintain head pressures. Such an installation is shown on the two smaller banks of Fig. 3. This was satisfactory in some instances, but had the inherent weakness that for some installations the cycling time, or cutting out and in time for the motors, was so short that their starting windings did not always kick out of the circuit, or the running time was not sufficient for them to cool off. This caused many of these windings to burn out.

To overcome this defect, one successful method devised is indicated in Fig. 4. It uses a modulating bypass valve. This control valve is normally closed. During winter, as soon as the head pressure in the system drops to 120 psig from the 136 psig design operating pressure, the modulating valve begins to open and the condenser begins to flood, because the hot gas then enters the condenser not only through its inlet, but also through its outlet. This action restricts the amount of liquid refrigerant that leaves the condenser, thus controlling the amount of liquid refrigerant that remains in the condenser and reduces the liquid level in the receiver.

As the condenser floods, the head pressure begins to rise correspondingly, and as soon as the desired head pressure is reached, the modulating valve maintains a constant level of flooding in the condenser in order to hold the head pressure of the system constant at 120 psig, regardless of the ambient temperature.

An air cooled condenser with this type of control is now being made in Idaho, primarily to control low head pressure with low outside air temperature.

Insure a Supply of Clean Air

Air cooled condensers are located in such a manner as to insure a supply of relatively clean air. They are usually put on roofs but may be installed within the building.

Where the installation is made within the building or machinery room, as is usually the case with evaporative condensers, short duct connections for air inlet or outlet are provided as required. Standard fan equipment is usually satisfactory to overcome duct resistance up to 50 ft of equivalent duct run.

For exterior or roof mounting, the air discharge is preferably in the direction of the prevailing winds, but this is not critical. Discharges are sometimes made toward a protecting wall. In other cases a windshield, as in Fig. 1, can be provided. This protection is, however, seldom required, as the air discharge from the propeller fans is conical with the fan axis and not axial. Therefore, discharges are not seriously affected, even when opposed by direct head winds of 10 or 15 mph or more.

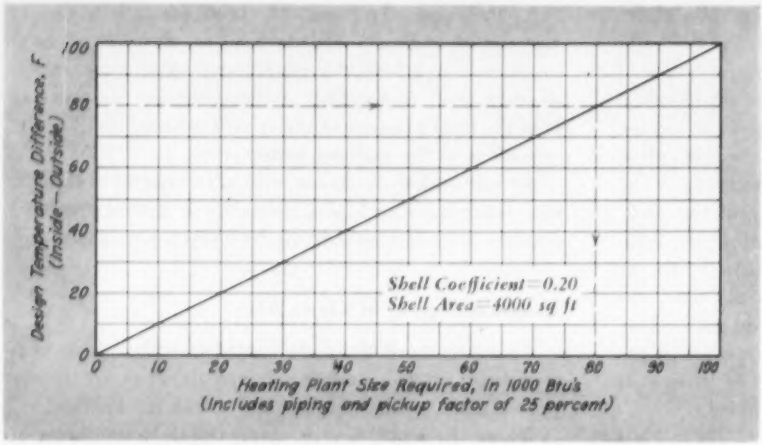
Conditions Justify Costs

Air cooled condensers can be used with refrigerant No. 12 wherever a relatively clean supply of outdoor air is available at dry bulb temperatures ranging from below zero to 95 F, regardless of the wet bulb temperature. Their application should be made under conditions prescribed above.

Their development for use with air conditioning systems using refrigerant No. 12 has been such that reliable equipment is now available for a considerable range of capacity. Where properly applied, very satisfactory results are assured.

First cost may equal or be as much as 10 percent greater than for other water conservation systems. Operating costs, for properly selected and applied equipment, depend on a number of factors that are best analyzed for the particular installation but are usually considerably lower than for other systems.

A general opinion on relative installation and operating costs can be inadequate and perhaps misleading. A careful study should be made if actual experience has not been available. Usually for systems up to 10 tons, the costs will be competitive. Larger installations are justified where water is not available in sufficient quantity, where water costs are prohibitive, or where the quality of the water is so poor that high maintenance and depreciation make water systems impractical or costly. ⁜



1 REQUIRED HEATING PLANT CAPACITIES for identical structures in different temperature zones may be compared here. Curve is plotted from results of multiplying the structure's Shell Coefficient by the Shell Area and by the design temperature differential

By Willie Hammer

Chief, Heating Unit
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Thermal Ratings of Buildings Can Be Uniformly Compared

. . . regardless of building size, location and construction, by using a standard rating known as the "Shell Coefficient." Here is a new approach to the problem, along with eight examples showing its practical application.

For another approach to the problem of efficiently rating the thermal qualities of buildings, see the article by F. W. Hutchinson in the March 1955 HPAC, pp. 121-123, and comments on it by Herbert T. Gilkey in the September 1955 HPAC, p. 94, and by R. A. Parsons in the December 1955 HPAC, p. 69.

Professor Hutchinson, of the University of California's mechanical engineering department, suggests the rating standard be called the Heating Economy Factor — and by analogy a Cooling Economy Factor — consisting of a single number from 1.0 to 10.

Dealing with the same variables affecting size and adequacy of a heating or air conditioning system, both Mr. Hammer and Prof. Hutchinson seek to reflect in a single uniform rating the thermal adequacy of any building by which it can be compared with that of any other.

As the nontechnical public increases its interest in heating and air conditioning costs and the related cost of insulation, the need arises for a standard to permit easy comparison of the thermal characteristics of buildings of different sizes and construction.

It must be possible to evaluate and point out in simple terms the necessity for increased equipment capacity and operational costs for greater areas of glass, for example. The advantages of structures well built with proper insulation and design must be demonstrable when compared with

those shoddily built and poorly insulated. It must be possible to demonstrate that the heating or air conditioning equipment installed is adequate for the thermal need of the building.

To fulfill this need for a standard for rating a structure, I suggest a "Shell Coefficient," U_T, based on the equation:

$$H = AU(t - t_o) \quad \ldots\ldots[1]$$

The Shell Coefficient is an average coefficient of transmission for the entire outer surface or "Shell Area" of the building. Calculations of thermal load through walls, roof, and floor would still have to be made, but the Shell Coefficient would be an extension of these calculations. The Shell Coefficient could be used to set standards, such as Excellent, Good, Fair, or Poor, with numerical limits for each rating.

The Shell Coefficient alone might prove sufficient to indicate satisfactorily the rating of a building. The use of the Shell Coefficient and Shell Area would permit calculations of capacities and approximate comparative operational costs for heating and air conditioning equipment. Knowledge of the coefficients of thermal transmission of walls, roof, floor, and glass and of the ratio of each to the total shell area would present additional information.

The simplest method of determining the Shell Coefficient, U_T, after a complete analysis of thermal load is:

$$H_T = A_T U_T (t - t_o) \quad \ldots\ldots[2]$$

$$U_T = H_T / A_T (t - t_o) \quad \ldots\ldots[3]$$

where: U = coefficient of transmission, Btu per hr per sq ft per F; A = area, square feet; H = heat loss or gain, Btu per hr; t and t_o = inside and outside design temperatures, F; and $_T$ = total shell.

Temperature is not a factor in the coefficient of transmission; therefore comparison of buildings in different temperature zones is independent of their locations. However, by multiplying the Shell Coefficient by the Shell Area and by the design temperature differential for a specific locality, the overall heat loss and required heating plant capacity can be determined.

Example 1. Determine the size of the heating plant required for a typical small building with a Shell Coefficient of 0.20 and a Shell Area of 4000 sq ft; compare for three different temperature zones, whose design temperature differences are 40 F, 65 F, and 80 F. Pickup and piping factor is 25 percent. Heat loss would be:

$$H_T = A_T U_T (t - t_o) \quad \ldots\ldots[2]$$

Heating plant size required, P, in Btu per hr, is:

$$H_T (1.25)$$

Therefore:

$$P_1 = (4000)\ (0.20)\ (40)\ (1.25)$$
$$= 40{,}000 \text{ Btu per hr.} \quad \ldots\ldots[4]$$

$$P_2 = (4000)\ (0.20)\ (65)\ (1.25)$$
$$= 65{,}000 \text{ Btu per hr.} \quad \ldots\ldots[5]$$

$$P_4 = (4000)\ (0.20)\ (80)\ (1.25)$$
$$= 80{,}000 \text{ Btu per hr.} \quad \ldots\ldots[6]$$

The heating plant capacities required for identical buildings in the three different temperature zones are shown in Fig. 1, plotted from the above equations.

Example 2. A commercial building with a Shell Factor of 0.4530 and a Shell Area of 238,000 sq ft is to be heated by two boilers. During the coldest part of the heating season, one boiler is found to be unserviceable. If the remaining boiler can deliver 4.5 million Btu per hr to the space to be heated, what would be the average temperature inside the building, with variations in the outside temperature to a low of zero F?

$$H_T = A_T U_T (t - t_o) \quad \ldots\ldots[2]$$

$$4{,}500{,}000 = (238{,}000)\ (0.4530)\ (t - t_o) \quad \ldots\ldots[7]$$

$$t - t_o = 4{,}500{,}000 / [(0.4530)\ (238{,}000)] \quad \ldots\ldots[8]$$

$$t = t_o + 41.7 \quad \ldots\ldots[9]$$

When zero outside:

$$t = 0 + 41.7, \text{ or } 41.7 \text{ F} \quad \ldots\ldots[10]$$

When 20 F outside:

$$t = 20 + 41.7, \text{ or } 61.7 \text{ F} \quad \ldots\ldots[11]$$

Inside temperatures corresponding to outside temperatures for this case can be determined from a plot made with these values.

By use of the Shell Coefficient and Shell Area, heating costs may also be compared. Some of the variables which affect the yearly cost of heating are: the length of the heating season, the number of hours of daily heating, and the desirable inside temperature. In order to standardize matters in this respect, all comparisons could be made with a 24 hr inside design temperature of 65 F. The heat loss would be proportional to $(t -$

What This Rating System Would Do

The method of rating and the possible uses of the information in this article for heating could similarly be used for cooling. Shell Coefficients could be called "Shell Coefficient (Heating), U_{TH}" and "Shell Coefficient (Cooling), U_{TC}", with $U_{TC} = U_{TH} +$ factors for heat gains from solar effects, equipment, and occupants. Shell Areas would be the same. Design conditions and operational conditions could be standardized to some extent for cost comparisons for cooling.

The acceptance and use of such a system of thermally rating buildings would:

- put a working tool in the hands of anyone interested in the heating or cooling of buildings.
- make the public more conscious of the necessity for good design and construction.
- enable materials manufacturers to illustrate more clearly the properties of their products.
- assist valuation engineers in determining quality of construction.
- permit building owners and managers to forecast approximate heating and cooling costs.
- permit building authorities to set standards which would tend to eliminate approval of construction of shoddy structures.

As the greater need for proper thermal design is realized, greater will be the need for qualified design engineers and greater will be the appreciation of the work and efforts of these engineers.

t_o), which in these cases would be $(65 - t_o)$. When t_o is the daily mean temperature, $(65 - t_o)$ is equal to the number of deg days with a 65 F base. The estimated heat loss for any period for an inside temperature of 65 F would then be:

$$H_T = A_T U_T D(24) \quad \ldots\ldots[12]$$

where: D = number of deg days per year.

The cost of heating for a year would be:

$$Y = A_T U_T D\ (24)\ (R) / 1{,}000{,}000 \quad \ldots\ldots[13]$$

where: Y = cost of heating per year; and R = cost per million Btu's.

Example 3. a) A building with a Shell Coefficient of 0.30 and a Shell Area of 4000 sq ft is in an area having 8000 deg days per year. The recommended heating plant can produce 1 million Btu for $1.50. What would be the approximate yearly cost to heat this building to 65 F?

$$Y = [(4000)\ (0.30)\ (8000)\ (24)\ (1.50)]/1{,}000{,}000 = \$345.60 \quad \ldots\ldots[14]$$

b) The cost of increased insulation to reduce the Shell Coefficient to 0.25 would be an additional $300. Approximately how long would it take to amortize this additional cost? (Interest, depreciation, etc. are omitted for simplicity. Also omitted is possible reduction of equipment cost in the case of a building to be erected.)

$$(U_T)_1 - (U_T)_2 = (0.30 - 0.25), \text{ or } 0.05 \quad \ldots\ldots[15]$$

Saving per year is:

$$[(4000)\ (0.05)\ (8000)\ (24)\ (1.50)]/1{,}000{,}000 = \$57.60 \quad \ldots\ldots[16]$$

Amortization period is:

$$300/57.60 = 5.2 \text{ years} \quad \ldots.[17]$$

Example 4. Six office buildings managed by a realty company in a large city are all heated by steam supplied by a utilities company at a uniform rate for all. The steam is used only for space heating. The Shell Coefficients and Shell Areas for the buildings are listed in Table 1. The meter for Building A has been checked recently, and it is felt that the bill for $31,400 is correct. On the basis of the heating costs for the same period, the realty company wants to know if any of the bills are out of line and whether the meters should be checked.

TABLE 1—SIX OFFICE BUILDINGS heated by steam from a utility were billed at a uniform rate. To find if any of the bills were out of line and if meters should be checked, the manager compared the factors shown

Building	Shell Coefficient	Shell Area, sq ft	Steam Bill, dollars
A	0.3010	870,000	$31,400
B	0.3650	925,000	$41,000
C	0.4300	800,000	$41,200
D	0.3840	1,000,000	$54,300
E	0.3560	900,000	$38,700
F	0.3250	750,000	$31,700

TABLE 2—DISCREPANCIES between actual and theoretical bills were found for Buildings D and F when shell areas and shell coefficients were compared

Building	Shell Area × Shell Coefficient	Ratio to Bldg A	Theoretical bill: Ratio × $31,400
A	262,000	1.0	$31,400
B	337,500	1.285	$40,600
C	344,000	1.313	$41,500
D	384,000	1.462	$46,200
E	320,000	1.220	$38,600
F	244,000	0.931	$28,410

Since the design temperature differences are the same, the buildings can be compared on the basis of Shell Area and Shell Coefficient alone. This is given in Table 2.

The greatest discrepancy between actual and theoretical bills appears to be for Building D, and the next largest for Building F.

Example 5. A company operating a chain of supermarkets has had its standard structure redesigned, making it a larger building. The standard structure has a Shell Coefficient of 0.1825, a Shell Area of 58,600 sq ft, and an average yearly heating cost of $1350. The new structure has a Shell Coefficient of 0.1610 and a Shell Area of 86,400 sq ft. What will be its approximate average heating cost for a year, Y, if both buildings are in the same city and have the same type of heating plant?

$$Y = (86{,}400/58{,}600)\ (0.1610)/0.1825)\ (1350) = \$1750 \quad \ldots\ldots[18]$$

It is sometimes desirable to be able to analyze the Shell Coefficient in order to determine where reductions in heat loss could be made most economically, to know the ratio of glass area to total Shell Area, and to show the proportionate effect of any of the building components on the total heat loss. This might be done as follows: Where: Q = infiltration, cu ft per hr; and where heat loss; through walls = $A_W U_W (t - t_o)$, through glass = $A_G U_G (t - t_o)$, through roof = $A_{RC} U_{RC} (t - t_o)$, through floor = $A_F U_F (t - t_o)$.

(Heat loss through the floor may be computed as shown in the ASHAE Guide for the type of floor desired. Dividing this heat loss by the actual floor area and the same temperature difference used for the other component areas will result in a theoretical but comparative coefficient of transmission.)

Heat loss by infiltration is:

$$0.240\ Qd\ (t - t_o) \quad \ldots\ldots[19]$$

Where: 0.240 = specific heat of air, Btu per lb per F; Q = volume of outside air entering the building, cu ft per hr; d = density of air at outside design temperature, t_o, lb per cu ft, which is 0.075 lb per cu ft.

Then,

$$U_T = [(t - t_o)\ (A_W U_W + A_G U_G + A_{RC} U_{RC} + A_F U_F + 0.018Q)] / A_T (t - t_o) \quad \ldots\ldots[20]$$

The factor $(t - t_o)$ is common to all items in the numerator and denominator of the above equation and therefore cancels out, leaving:

$$U_T = (A_W U_W + A_G U_G + A_{RC} U_{RC} + A_F U_F + 0.018Q)/A_T \quad \ldots\ldots[21]$$

or

$$U_T = (A_W/A_T) U_W + (A_G/A_T)\ U_G + (A_R/A_T)\ U_R + (A_F/A_T) U_F + (0.018Q/A_T) \quad \ldots.[22]$$

Since

$$A_T = A_W + A_G + A_R + A_F \quad \ldots\ldots[23]$$

the first four fractions in Equation No. 22 respectively indicate the ratio of walls, glass, roof, and floor areas to the total Shell Area. The area ratio × the coefficient of transmission, U, indicates the part the building component plays in determining the Shell Coefficient, U_T.

The fifth part of the right hand side of Equation No. 22 does the same for infiltration. If desired, separate ratios and coefficients could be used for any other building components — for example, door areas — or to show the percentages and effects of windows using insulated and noninsulated glass.

Example 6. What is the Shell Coefficient of a building to be constructed having dimensions and coefficients of transmission as follows: A_W = 850 sq ft; A_G = 280 sq ft; A_{NC} = A_F = 1050 sq ft; A_T = 3230 sq ft; U_W = 0.19; U_G = 1.13; U_{NC} = 0.14; U_F = 0.20; and Q = 4200 cu ft per hr.

$$U_T = (A_W/A_T)U_W + (A_G/A_T)U_G + (A_N/A_T)U_{NC} + (A_F/A_T)U_F + (0.018Q/A_T) \quad .[21]$$

$$U_T = (850/3230)0.19 + (280/3230)(1.13) + (1050/3230)0.14 + (1050/3230)0.20 + (0.018)(4200)/3230$$

$$= 0.2819 \quad .....[24]$$

The area percentages and coefficients could be compared as follows:

Component Area	Percent of Total Shell Area	Coefficient of Transmission
Wall	26.3	0.19
Glass	8.7	1.13
Roof	32.5	0.14
Floor	32.5	0.20
Infiltration: 4200 cu ft per hr		
Shell Coefficient: 0.2819		
Shell Area: 3230 sq ft		

Example 7. Using only the data compared above, determine:

a) In the above structure, which component has the greatest percentage of the total heat loss?

b) If the structure is in an area having 6000 deg days per year and has a heating system which will produce 1 million Btu for $2.00, which would be more advantageous: (1) to install double glazed windows having a coefficient of transmission of 0.55, or (2) to install insulation between the ceiling and roof to reduce the coefficient of transmission to 0.08?

c) What would be the resultant percentage heat loss through the glass area to the total heat loss if the double glazed windows were installed?

Solutions to Example 7:

a) Glass area, which accounts for the largest heat loss, is 34.8 percent of the total loss:

$$(0.087)\ (1.13)\ (100)/(0.2819) = 34.8 \text{ percent} \quad .....[25]$$

b) Changing only the coefficient of transmission of glass would save $46.98 per year in heating cost:

$$0.087(1.13 - 0.55) = 0.0505 \quad .[26]$$

and

$$(3230)\ (0.0505)\ (6000)\ (24)\ (2.00)/1{,}000{,}000 = \$46.98 \quad ...[27]$$

Changing the roof coefficient only would save $18.17 per year in heating cost:

$$0.3250\ (0.14 - 0.08) = 0.0195 \quad .[28]$$

and

$$(3230)\ (0.0195)\ (6000)\ (24)\ (2.00)/1{,}000{,}000 = \$18.17 \quad ...[29]$$

For this structure, the owner could afford to pay $46.98/18.17, or 2.6 times as much, to install 280 sq ft of insulating glass as for 1050 sq ft of insulation to reduce the roof coefficient of transmission from 0.14 to 0.08.

c) The resultant percentage of heat loss through double glazed windows to the total heat loss would be 20.6 percent:

$$(0.0870)\ 0.55\ (100)/(0.2819 - 0.0505) = 20.6 \text{ percent} \quad .....[30]$$

Example 8. An office building to be constructed of a type of concrete wall with a coefficient of transmission of 0.35 has a Shell Coefficient of 0.3050 and a Shell Area of 940,000 sq ft. The area of wall, not including glass area, is 350,000 sq ft, or 37.23 percent of the total Shell Area. If light-weight concrete type construction with a wall coefficient of transmission of 0.18 is used instead, what would be the required capacity of the heating equipment, and the approximate savings in heating cost per year? The building is to be in a city with an average of 5800 deg days per year and will have a design temperature difference of 60 F. The heating cost will be $0.90 per million Btu.

The Shell Coefficient will change only in the wall factor:

$$0.3723\ (0.35 - 0.18) = 0.0634.$$

The new Shell Coefficient is:

$$0.3050 - 0.634 = 0.2416 \quad ....[31]$$

The required heating capacity, Btu per hr, is:

$$940{,}000\ (0.2416)60 = 13{,}620{,}000 \quad .....[32]$$

With piping and pickup loss of 25 percent, the required capacity, Btu per hr, is:

$$1.25\ (13{,}620{,}000) = 17{,}025{,}000 \quad .....[33]$$

Annual saving in heating cost is:

$$(940{,}000)\ (0.0634)\ (5800)\ (24)\ (0.90)/1{,}000{,}000 = \$74.50 \quad ..[34]$$

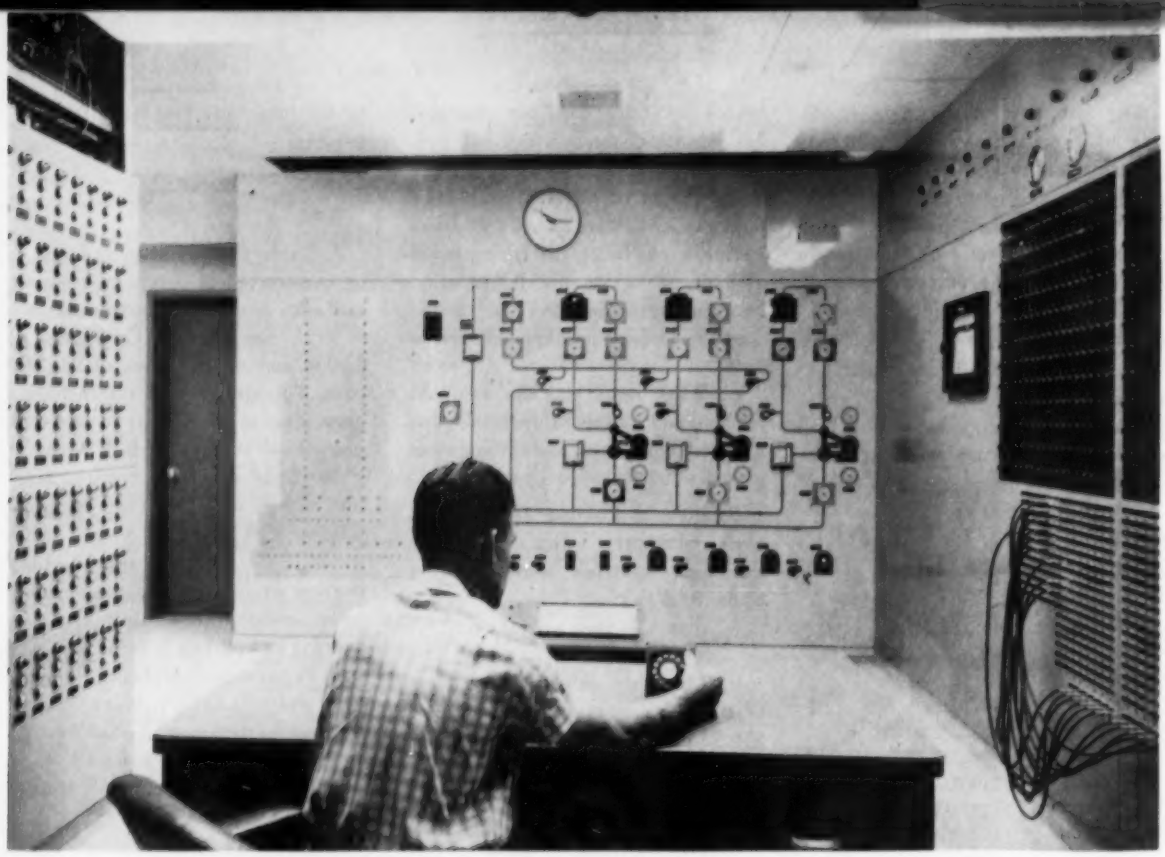
Du Pont Offers Refrigerant Numbering System to All

. . . to make gas identification easier

THE DU PONT CO. has offered to make generally available a simplified numbering system developed over the last quarter century to identify chemical compounds used as refrigerants, according to R. J. Thompson, director of sales, Kinetic Chemicals Div.

Acceptance of the proposal, made initially to The American Society of Refrigerating Engineers, would eliminate confusion existing in the refrigeration industry due to similarity of fluorinated halo-hydrocarbon refrigerants. A common numbering system not only would simplify equipment designers' and manufacturers' work but would greatly assist servicemen in identifying and using the proper cooling agent in repair work, regardless of the source.

The proposal already has been accepted by the Standards Committee and Council of ASRE and will be incorporated into an ASRE Standard on Refrigerant Designation for approval by the general membership in the near future.



COMFORT AT HIS FINGERTIPS — At the new Bank of the Southwest building, the engineer can read temperatures from 400 points in the building by dialing a code number at his desk. The number dialed shows in lights, and the reading appears on a scale. Telephone jacks at right can be plugged in to record temperatures. Buttons on left are for starting and stopping major electrical equipment in the air conditioning system. Color graphic diagram of heating and air conditioning installation and pilot lighted profile of building on rear wall tell at a glance how various pieces of equipment are operating. Public can observe operations through window

How Automation Cuts Costs

. . . of air conditioning buildings

Master panels that collect key operating data on air conditioning, heating, refrigeration, and ventilation systems and provide for remote control of the equipment from a central point are being used in many buildings to reduce cost and increase comfort. Known as supervisory data centers, they are often made an architectural feature of the building, installed so that the general public and building tenants may observe them in action.

ADVANCED AUTOMATION techniques for the control of air conditioning, heating, and ventilating systems are being applied in office buildings, shopping centers, hospitals, and other structures to cut the cost of building operations and increase occupant comfort, according to C. M. Sanders, market manager of electronics, and E. J. Roach, market sales manager, of the commercial division of Minneapolis-Honeywell Regulator Co. By means of master control panels known as supervisory data centers, key operating information on an air conditioning system — for example

— is collected at a central point. Remote control devices at the same point supervise the system's operation.

While the method can be used to assist in preventive maintenance by detecting faulty functioning of equipment before it can cause serious trouble, its most valuable contribution to building efficiency is operation of the complete system as a unit by continual checking and logging of temperatures and other data, adjustment of controls, starting and stopping equipment, and investigation and handling of complaints — all from a centralized location.

One of the earliest such "graphic" control panels was installed in the White House in 1952, as described in the June issue of HPAC that year. Modern types have been designed and built during the past year for such structures as the new Prudential Insurance Co. Mid America building in Chicago, the Dallas Federal Savings and Loan building in Dallas, the Pacific Telephone and Telegraph building in San Francisco, and many more, according to Messrs. Sanders and Roach. Smaller buildings and rambling shopping centers are utilizing supervisory equipment and techniques, too. So are some existing buildings, including the Guaranty Trust building in New York and the Shannon Memorial hospital in San Angelo, Texas, where extensive modernization work is underway.

In a typical installation, the supervisory panel is mounted in the engineer's office; although in some buildings — notably the new Bank of the Southwest building in Houston — it is placed on public view in a busy lobby. Here it serves as a reminder to tenants and customers of the steps taken by the management of the building to insure comfort.

Studies of early installations reported by Messrs. Sanders and Roach show that a supervisory data center costs between 2 and 5 percent of the total cost of a building's heating and cooling system. Savings in personnel and increased efficiency of equipment usually make it possible to liquidate this cost quickly and long-term savings continue to accrue, they state.

What the Panels Show

The panels graphically display temperature and humidity of zones or individual rooms throughout the building. Continuous readings of outside air temperature are provided on the central panel. Coils, fans, valves, motors, and other pieces of operating equipment are colorfully and graphically presented. Dials give information on temperature, flow, pressure and many other facts about the operation of the heating-ventilation-refrigeration-air conditioning equipment. Switches and indicating gages provide for instantaneous readings of temperatures and simultaneous conditions from several locations. Pilot lights tell when key equipment starts and stops in any area.

From this information, the operating engineer can determine if the equipment is functioning at peak efficiency. He can locate and correct troubles in the system — usually without leaving his dial-studded desk in the central control room. Or he can dispatch a man to the spot where adjustment is needed with specific information on the changes required.

Normally, the control functions are performed automatically by the system. But the engineer can make changes from his panel as necessary to meet individual comfort needs, solve special temperature problems or increase the efficiency of the operating equipment.

Pneumatic or electronic temperature control systems can be adapted with equal ease to supervisory panel control. The White House had one of the earliest pneumatic systems. Prudential's Chicago building uses both types. The Bank of the Southwest building is one of the first major all-electronic systems.

How System Might Operate In Typical Five-Story Office Building

AT THE START of the day, the building engineer goes to the section of the control board that depicts the primary air system in miniature. To ventilate the building, he starts the exhaust and supply fans, which are on the roof of the building. He also starts the six zone supply fans, which are on each floor. He presses a button and reads the outside air temperature, feels that cooling will be required during the day.

He switches the system to summer operation and starts the circulating pumps to the room units, which are controlled by individual room thermostats. Then he starts the condenser water pump, cooling tower fan, and the chilled water pump. Once all three of these have started, the compressor starts automatically.

Without a supervisory data center, this starting of equipment would require coming in two hours earlier and traveling through the building to start the various pieces of equipment. The shorter running time of fans, pumps, etc. results in savings in electrical power and steam, and longer equipment life.

After attending to other duties for 10 or 15 minutes, he returns and checks the chilled water temperature as shown on his chilled water temperature controller. If he finds the water temperature is not satisfactory he can adjust it with a knob.

He has a note on his desk about a sales meeting in tenant offices on the third floor. He adjusts the ventilation and temperature accordingly.

By 8:30 a.m. he is ready to take his first log of temperature throughout the building. If nothing unusual is noted, his only duty as far as the air conditioning system is concerned is to log temperatures hourly the remainder of the day.

Later, he gets a call from the fifth floor. The office manager says that it is too cool. The engineer checks the space temperature on his board, increases the setting 2 F, and so informs the office manager.

At his 2:00 p.m. logging, he notices that the temperature leaving the dehumidifier coil is higher than it should be. He notes that the chilled water temperature being supplied by the refrigeration equipment is correct. He tries adjusting the dehumidifier thermostat to a lower value, but nothing happens. He sends a man to investigate. The man reports that the source of trouble is a clogged strainer and that the situation has been remedied. The operation of the system has returned to normal with the tenants of the building still unaware of the temporary difficulty.

Without the frequent logging made possible by the control center, this might not have been detected until the entire building became uncomfortable.

As advances are made in the detection and control of variables that affect human comfort, as new factors are discovered and as advances are made in the design of "comfort generating" equipment for commercial buildings, the functions performed by a supervisory system can be increased, Messrs. Sanders and Roach point out. Wind direction indicators, wind velocity indicators, sun intensity meters and other detecting devices could be added to existing supervisory systems. Some small installations are already equipped with typewriters which automatically write messages advising the operator of conditions that need correction somewhere in the building.

Assists Club Manager

To promote understanding of the functions performed by supervisory data center control of air conditioning systems, let's look at a few examples as given by Messrs. Sanders and Roach:

The Shreveport (La.) club is a small one where the responsibility for operating the air conditioning system is shared by a maintenance mechanic and the club manager. The maintenance mechanic works regular daytime hours but during the evenings when the club is the busiest, only the club manager is present. Without the centralized control, he would have a difficult problem in regulating the air conditioning to suit varied activities in the different club rooms during the evening. With the control, however, by pushing buttons he can start air conditioning units serving those areas that will be in use. Pilot lights show at all times which units are running. He can then adjust the temperature with knobs to suit the needs of the particular group. For example, for a large, active group, the temperature may be reduced. But for a small, quiet gathering, a higher temperature might be desired. Another knob permits the manager to adjust the ventilation to the needs of the group using the room. For crowded rooms where there is considerable smoking, 100 percent outside air can be used, but this outside air can be reduced for smaller groups, saving operating costs.

To make the panel more attractive, and to make the relationship between the adjustments and the air conditioning system easier to understand, color-coded diagrams of the air conditioning system are shown on it.

Simplifies Store Operation

The control panel for the Carson Pirie Scott & Co. suburban department store, Wilmette, Ill., has two additional features. The air conditioning units and the duct layouts are shown on actual floor plans of the three floors of the building, to make it easier to see at a glance which air conditioning unit serves which area. Also, an indicator is included that makes it possible to read the temperature in the various zones in the store.

For example, to check the temperature in a particular store location, it is necessary merely to press a button placed in the corresponding location on the store floor plan. If the temperature is not satisfactory, it can be adjusted by turning a knob. Also, each air conditioning unit can be turned on and off at the panel, a pilot light indicating whether the unit is running.

Eight Story Office Building

A supervisory control center is used to operate the air conditioning plant in an eight story office building of the New England Telephone & Telegraph Co. at Providence, R. I.

Temperature indicating buttons and adjustment knobs are shown on the floor plans of each of the eight floors. Temperatures in any zone on any floor can be read on an indicator by pressing a button, and if necessary, a twist of a knob will adjust them.

On the board is a diagram of the fan systems. The fan can be started and stopped, temperatures can be read, and supply air temperatures can be adjusted. This makes it possible for the operating engineer to analyze the performance of his air handling system, and make adjustments for best performance.

Pays Off For Skyscraper

A supervisory data center is even more valuable for a major office building such as the 41 story Prudential building on Chicago's lake front, opened last December. This building has a total of 40 interior zone systems and 10 primary air systems. The private offices on the exterior of the building are air conditioned by 2600 induction units.

There are 1200 electric and pneumatic thermostats in private offices which may be adjusted by the occupants. The building maintenance department, however, is responsible for selecting the temperatures to be maintained in the open areas in the interior of the building, and it is also responsible for the adjustment of the thermostats controlling the primary air supply and the secondary water supply to the induction units.

To check on the operation of these thermostats and to make the necessary adjustments would normally require trips throughout the building by a large maintenance crew. Checking would not only involve the travel time to get to their locations, but also they frequently require work in inaccessible locations. With the supervisory central control, however, one man at the panel in the basement can check all of these key temperatures — including control through 180 additional electronic thermostats — in interior zones and in the primary air systems, and can make any necessary adjustments without leaving the panel. According to Robert Spooner, maintenance engineer for the building, the centralized control saves the need for an additional two operating men. Figuring "conservatively," the investment will pay off in from six to eight years.

There are 40 fan rooms in the building. Color tapes on the start and stop buttons to indicate when fans for various spaces should be in operation are changed when requirements change. Buttons marked with red

tape show fans that operate from 6 a.m. to 6 p.m.; yellow indicates 24 hr a day operation; blue shows fans that run until 10:30 p.m. No color on button indicates fan being worked on or fan serving unoccupied space.

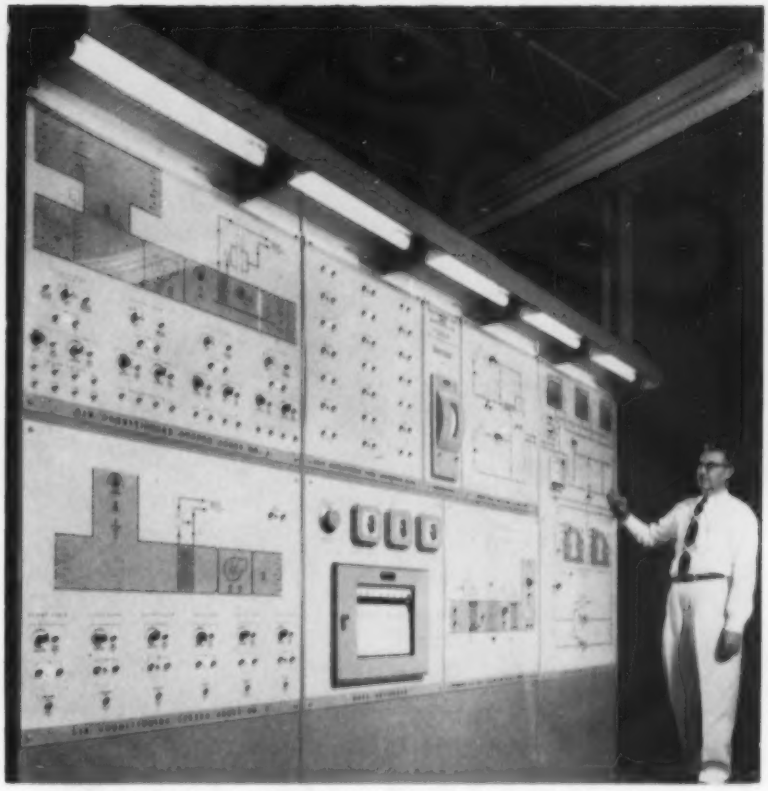
While Prudential purchased this control equipment as an investment, there has been a great deal of public interest in this method of supervising the air conditioning system. Prudential has responded by placing a display in one of the lobbies showing how the temperatures are supervised throughout this 41 story building.

The Baltimore Gas and Electric building installation is an example of an application in an existing building to which air conditioning has recently been added. It also illustrates how supervision of the refrigeration plant, the fan systems and space temperatures can be combined.

The refrigeration system is shown on the board. The two compressors are started automatically and are controlled by an instrument which indicates chilled water temperature and which can be reset at the panel. Other temperatures are indicated when a "Temperature Check" button is depressed. Pilot lights show what equipment is operating.

The panel provides complete supervision of the primary air unit for the main building. Also, unit conditioners in this building can be started and stopped from the panel.

The air conditioning systems for Annex No. 1 and Annex No. 2 are shown on the board. The return air temperature for Annex No. 2 is adjusted at the panel, but Annex No. 1 is controlled by local space thermostats. The mixed air temperature and coil duct temperature are adjusted at the panel.



SUPERVISORY PANEL FOR EXISTING BUILDING was installed when Baltimore Gas and Electric Co. office was air conditioned recently. Operator stands near color graphic diagram of refrigeration system containing pilot lights to show equipment in operation, start-stop buttons, and instrument for continuous checking of chilled water temperature. A knob for changing water temperature and buttons for checking air temperature in the primary air system are also provided on this panel. Next to it are sections showing the heating-cooling piping circuits in the building (above) and a diagram of the primary air unit with temperature reading buttons, start-stop switches for fans and adjustment knobs for temperature set points. The next panel (above) contains a bank of start-stop buttons for individual fan coil units and below it is a recording instrument and switches for charting temperatures as various points throughout the building. At the left are panels showing and controlling air conditioning in two annexes

An Architectural Feature

All the panels so far described are unseen servants, known and appreciated only by the engineers. Lately, there has been a trend toward capitalizing on this control method as an architectural feature and an interesting attraction for the general public.

For example, consider the installation at the Bank of the Southwest, in Houston. Here, the supervisory data center is next to the elevators, behind glass for everyone to see.

This installation uses a new method of checking temperatures. Since there are over 400 temperature check points, a telephone dialing system replaces the pushbuttons ordinarily used. The engineer can read temperatures at any location by dialing the proper code number.

At the British Columbia Electric Co.'s new central office building in Vancouver, the center dramatically appears in the lobby. Windows open not only into the control room, but through it into the room containing the air conditioning compressors, hard at work consuming the owner's product —— electric power.

Data Typed Automatically

In an installation now being designed, it will no longer be necessary to push buttons and log temperatures regularly. An automatic data logging and alarm system will automatically log hourly key temperatures in the air conditioning system. These temperatures will be listed in the proper column on a log sheet by an electric typewriter. If any temperature is out of its normal range, an alarm light will turn on and the temperature will be typed in red on the log sheet. ✠

1 FUSION WELDED CHROME-MOLY PIPE — 30 ft section — was given a 90 deg bend and an offset of 24 deg, 18 min on an 11 ft radius. Five different heats were required. The 27½ in. OD, 1½ in. thick pipe is part of a 475 psig, 1050 F steam reheat line

How the Main Piping Was Designed For TVA's Gallatin Steam Plant

Principal piping for the Gallatin steam plant, No. 7 in TVA's design and construction program, was designed for 2000 psig and 1050 F. Described here are the materials and design considerations for the main and reheat steam piping, boiler feedwater piping, extraction steam piping, drains, vents, and blowdown piping.

By Roy E. Lyon

Mechanical Engineer
Division of Design
Tennessee Valley Authority

GALLATIN STEAM PLANT is the seventh steam generating plant to be designed and built by the Tennessee Valley Authority. The plant is on the Old Hickory dam reservoir, approximately 10 miles south of Gallatin, Tenn.

The two units in the plant have a combined capacity of 500,000 kw. The steam conditions under which the piping was designed are 2000 psig, 1050 F, with reheat to 1050 F.

All piping was designed, fabricated, and installed in accordance with appropriate sections of the American Standard Code for Pressure Piping and the American Society of Mechanical Engineers Boiler Code in effect at the time of design. Following the procedure used for other steam plants (*How Piping Was Designed for the World's Largest Steam Plant*, in the March and April 1956 HPAC's), the flows for the lines of the various principal piping systems were tabulated and velocities and pressure drops were calculated, based on assumed routings through the plant. The line sizes, velocities, and pressure drops were recalculated after the final routings were established and adjustments in sizes made where necessary.

Main and Reheat Steam Piping

The main steam piping for all units is low alloy steel, forged and bored. The piping is 21.5 in. outside diameter by 3.375 in. thick walls for full 1,650,000 lb per hr steam flow and splits into two 15.75 in. OD by 2.5 in. thick lines before the turbine

throttle valves. The pipe conforms to American Society for Testing Materials Specification A158, Symbol P-22, containing 2¼ percent chrome and 1 percent molybdenum.

The reheat steam piping is 27.5 in. outside diameter by 1.25 in. thick walls for full flow and splits into two 20.0 in. OD by 1.0 in. thick walls before the intercept valves at the turbines. The pipe conforms to ASTM Specification A155, Symbol 2¼ CR, Class 1, electric fusion welded for high temperature service.

The low temperature return steam lines from the turbines to the reheater inlet headers are carbon steel conforming to ASTM Specification A106, Grade B. Two 20.0 in. outside diameter by 0.5 in. thick wall lines were provided per unit.

No valves are used in the main steam or reheat steam lines between the turbine. The superheater and reheater outlet headers, and the piping is welded throughout.

A study of the plant arrangement indicated that from a space standpoint the steam generators required a spacing of 124 ft center to center to accommodate the long retractable soot blowers in the superheaters and reheaters, air ducts, etc. This spacing was sufficient to allow the longitudinal center line of the turbogenerators to be located at an angle of 90 deg from the transverse center line of the steam generators and thus reduce considerably the width of the turbine room. This arrangement, however, meant longer steam lines than were necessary on previous plants. The extra cost of the steam lines, however, was considerably less than the saving in building cost.

Following the procedure found most economical on previous plants, the small superheater and reheater tubes were carried forward and down a short distance in front of the steam generators to provide flexibility for the vertical runs of the main and reheated steam lines. Preliminary drawings of the lines were made and rough calculations made of the stresses in the pipes and moments on the outlet headers and turbine stop valves. Considerable difficulty was experienced at this point, as the large stiff lines exerted a higher force and moments than allowable at the turbine throttle and intercept valves. Altogether a total of 16 different layouts were calculated and portions of several of them tested before a satisfactory arrangement was found. Scale model tests of the complete layouts were then made to check the calculations and determine anchor points.

Boiler Feedwater Piping

Eight stages of feedwater heating are provided, with No. 4 heater being of the open, deaerating type. Condensate is pumped from the condenser hotwell through the low pressure heaters into No. 4 heater. From No. 4 heater the water flows to the suction of the boiler feedwater pumps and is pumped progressively through heaters Nos. 3, 2, and 1 to the economizer inlet of the steam generator.

All piping between the condenser hotwell and the boiler feedwater pump suction is 8, 12, and 18 in. Schedule 40 seamless steel, conforming to ASTM Specification A106, Grade B. All piping between the boiler feedwater pump and the steam generators is 10 and 14 in. Schedule 160 seamless steel, conforming to ASTM Specification A106, Grade B. All joints are welded except at the following points where flanges are provided for servicing equipment:

1) Condenser hotwell outlet.

2) Hotwell pump suction and discharge.

3) Boiler feedwater pump suction and discharge.

4) Condensate regulating valve inlet and outlet.

All valves are cast steel body conforming to ASTM Specification A216, Grade WCB, with stainless steel trim. All gate, globe, and check valves are welded into the lines and all large valves in the boiler feedwater pump discharge lines are electric motor operated.

Electric motor operated, three-way valves are provided in the condensate line to the low pressure heaters to bypass the condensate around the heaters during startup or in case of difficulty with the heaters or controls thereon. Similar valves are also provided to bypass the boiler feedwater around heaters Nos. 1, 2, and 3 during startup or in case of trouble with the heaters.

The three boiler feedwater pumps per unit — one is a spare — are driven by constant speed motors through fluid drives, thus providing the necessary speed variation of the pumps to maintain the water level in the steam drums and eliminate the need for feedwater regulating valves in the pump discharge system as well as effect a saving in the cost of operating the plant.

Makeup water for the steam generators is normally provided by evaporators but may be provided from storage tanks built into the substructure of the powerhouse. These tanks — one per unit — are connected into the feedwater system ahead of the No. 4 heater in such a way as to provide for surges in the system and to provide a supply of water for sealing turbine and pump glands, etc. Level controllers on the No. 4 heaters control diaphragm valves in the makeup and bypass lines to regulate the level of the water in the No. 4 heaters. The level in the condenser hotwell is maintained constant by a level controller on the hotwell and controlling diaphragm valves in the hotwell pump discharge lines.

Extraction Steam Piping

All extraction pressures and temperatures, except the lines to Nos. 1 and 3 heaters, are within the allowable temperature range for carbon steel pipe. Consequently, pipe conforming to ASTM Specification A106, Grade B, was used. The Nos. 1 and 3 extraction temperatures were above that considered good practice for carbon steel and low alloy steel. Pipe conforming to ASTM Specification A335, Symbol P-11, containing 1¼ percent chrome and ½ percent molybdenum was used for these lines.

The design pressures and temperatures and the pipe sizes and weights are as follows:

No. 1 extraction: 760 psi, 850 F, 6 in., Schedule 80.

No. 2 extraction: 476 psi, 667 F, 10 in., Schedule 40.

No. 3 extraction: 200 psi, 850 F, 8 and 10 in., Schedule 40.

No. 4 extraction: 117 psi, 707 F, 10 in., Schedule 40.

No. 5 extraction: 65 psi, 580 F, 2-8 in., Schedule 40.

No. 6 extraction: 35 psi, 453 F, 12 and 16 in., Schedule 30.

No. 7 extraction: 15 psi, 317 F, 2-12 in., 0.375 in. wall.

No. 8 extraction: 7 psi, 201 F, 4-18 in., 0.375 in. wall.

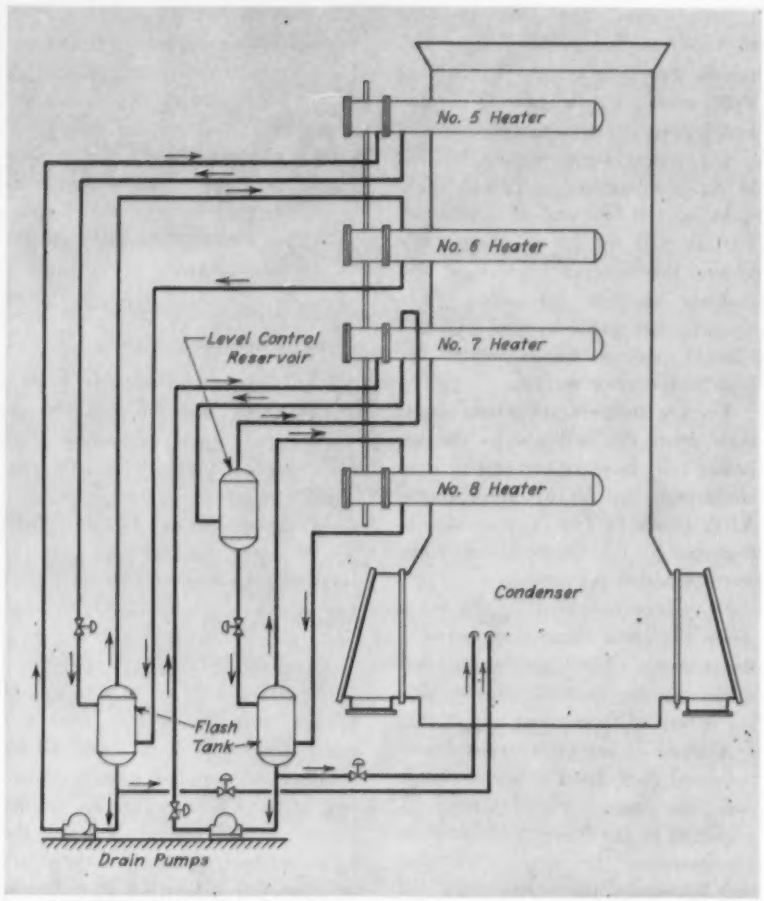
Valves are welded into the lines to eliminate joints wherever possible, and the piping is welded throughout. The lines to the low pressure heaters in the condenser neck are welded to eliminate possible leaks that would require a shutdown to repair.

Positive closing check valves are provided in all extraction lines to heaters having sufficient volume to overspeed the turbine in case of loss of load. Ordinary swing check valves are provided in the other extraction lines where recommended by the turbine manufacturer.

The shutoff valves at heaters Nos. 1 through 4 are electric motor operated and tied into the control system so that they will be closed automatically in case of abnormally high level in the heaters.

Since all extraction lines are subject to pressures less than atmospheric during startup, valved drain lines are provided to drain the lines to the condenser until the pressure in the lines is sufficiently high to operate the normal trapped drain lines.

Flexibility is provided in the lines to heaters Nos. 1, 2, 3, and 4 by bends and offsets in the piping between the turbine and the heaters. Corrugated type stainless steel expansion joints with internal sleeves are provided in the low pressure lines inside the condenser neck.



2 EMERGENCY DRAIN LINES from the pump suction headers to the condenser bypass the heater drains to the condenser in case of pump failure. Drain lines between heater outlets and diaphragm control valves are designed for very low velocities to prevent flashing and erosion

Drains, Vents, and Blowdown

The heater drain system is designed to cascade the drains from any particular heater to a heater of lower pressure, through diaphragm control valves, where possible. Due to low pressures in some of the low pressure heaters, it is necessary to pump these drains forward into the condensate system. Another factor considered in the low pressure heater drains is the large amount of condensate which is of little value in a lower stage heater and complicates the piping problem by increasing the pipe sizes in what is usually a congested area. To take advantage of the heat available without putting excess condensate through the lower pressure heater, the scheme shown in Fig. 2 was worked out. Briefly the system works as follows:

The drains from No. 5 heater pass through a control valve to a flash tank which also serves as a drain tank for heater No. 6. Since the pressure in this tank is the same as in No. 6 heater, a portion of the drains from No. 5 will be flashed to steam and pass out of the top of the tank to the shell of No. 6 heater. That portion of the No. 5 drains not flashed plus the drains from No. 6 are then pumped forward into the condensate line between Nos. 6 and 5 heaters or into the inlet water channel on No. 5 heater. Heaters Nos. 7 and 8 are handled the same way except that No. 7 heater does not have a subcooling section and a level control reservoir is required ahead of the control valve to provide sufficient capacity for satisfactory operation of the level controller. Duplicate heater drain pumps are not provided; therefore, emergency drain lines from the pump suction headers to the condenser are provided to bypass the heater drains to the condenser in case of pump failure or during other emergency conditions. The flash tanks are below the heaters

and high enough above the heater drain pumps to provide a positive head on the pump suction.

Prevent Flashing and Erosion

The drain lines between the heater outlets and the diaphragm control valves are designed for very low velocities to prevent flashing and erosion of the piping system. Piping on the discharge side of the control valves is as short and direct as possible, in most cases the control valve being directly over the heater opening into which the drains are discharged. All piping is seamless steel conforming to ASTM Specification A106, Grade B.

Gate and globe valves are cast or forged steel with stainless steel trim and welded into the line.

Diaphragm control valves for controlling heater drain flows are 4 to 6 percent chrome steel body with stainless steel seats and trim for all pressures 150 psig and above and for all temperatures 411 F and above. Control valves for lower pressures and/or temperatures are cast steel body with stainless steel seat and trim. All control valves are flanged and arranged to close on loss of operating medium. They are designed for a maximum flow approximately 10 percent in excess of the maximum calculated flow. The valves are controlled pneumatically from torque tube type controllers on the heater shells or drain tanks.

All control valves in the heater drain system are bypassed with hand operated V port globe valves of approximately the same size as the control valve port.

All steam safety valves are provided with vents to carry the steam to 6 ft above the roof of the plant. In some cases, this necessitated rather long lines. These vents are designed in accordance with a method of applying the acoustic velocity principle to the flow inside the vent pipe.

High pressure heaters and evaporators are vented to the No. 4 heater, which is in turn vented to the atmosphere through the vent condenser, thus conserving heat and releasing a minimum of vapor into the building. The low pressure heaters are vented to the turbine steam condenser. The piping is welded throughout using socket welding fittings except that connections to heater shells are flanged. Valves are forged steel with socket welding ends. Those used for throttling service are of the V port type. ⧺

Photo courtesy Blaw-Knox Co.

Warm Air Heaters Cut Plant's Fuel Costs

. . . provide uniform working temperature of 70 F

SIX GAS FIRED warm air space heaters, at strategic spots in the 165,000 sq ft Garland, Texas, fabricating plant and warehouse of the Oil Well Supply Division of United States Steel Corp. provide a uniform working temperature of 70 F, according to the Dravo Corp. The major problem in many Southern industries is comfort when it is needed and rapid dissipation of the heat at its source when the sun takes over. The heaters each have a capacity of 2 million Btu per hr and are thermostatically controlled to cut off warm air as soon as the 70 F level is reached, either by heater or by solar heat gain.

The plant is of structural steel frame covered with a protective corrugated steel roof and sidewalls. Two heaters were installed in the original plant, and when a 90,000 sq ft addition was erected, four more were added.

Because the heaters require no steam or hot water lines and the outer casing of the equipment consists of two sheets of metal with an effective insulating air space between, there is no override of heat after the heaters cut out. Conversely, there is no lag in heat delivery when the units are started up to dispel the morning chill.

Fuel costs are low because the heaters can be operated independently.

The heaters are installed in an upright position between bays of the plant. Two of the four air throw nozzles on each heater discharge into 50 ft lengths of ductwork to distribute warm air to remote sections of the structure.

Thermostats are mounted inside the return air grilles at the base of each heater. Because the heaters operate on an air recirculation principle, the controlling thermostat mounted in the return air stream would result in the most efficient operation. The thermostat shuts down both the fan motor and the gas burner when the return air design temperature is reached.

Each heater handles 22,000 cfm of air. Air is pulled in from floor level, passed over the combustion chamber and discharged through nozzles at the top. Effective air throw of each unit is approximately 150 ft.

Besides the short ductwork, the only connections required for installation of the units were fuel lines, exhaust stacks to the roof, and electric power line to operate the three-phase, 60 cycle motors. ⧺

Air Condition Leading Department Store

. . . completely by next year

ALL selling and customer service areas will be air conditioned by Carson Pirie Scott & Co., Chicago department store, by May 1957, according to Bruce MacLeish, chairman.

Installation of basic refrigeration equipment to adequately and completely air condition the downtown space owned or leased by Carson's was completed recently.

The commercial space as leased—180,000 sq ft—will be air conditioned, as well as 40,000 additional sq ft of selling area and 35,000 sq ft of sales supporting and office space in property acquired last year. ⧺

1 NIGHT AIR COOLING TEST ROOM in office building contained six point electronic temperature recording potentiometer that measured wet bulb temperatures with immersed wicking and blower. Equipment also recorded room and outdoor wet and dry bulb temperatures, entering water and discharge air temperatures, and frequency of cooling unit damper operations

Night Air Cooling Cuts Refrigeration for Air Conditioning

2 TEST OFFICE BUILDING — test room is northeast corner room on second floor — has 12 in. brick walls and built-up roof over reinforced concrete pan construction, with 2 ft attic space

Night air cooling by remote unit fan operation — using 100 percent outside air — between 2 and 6:30 a.m. reduced room air temperature an average of 3.7 F in summertime tests in an office building. Thus, these tests indicate night fan operation may be a logical solution to the problem of temperature and humidity nighttime build-up in many different types of buildings, including office buildings, schools, churches, and unoccupied hotel rooms.

By John Kline
Field Engineer
Herman Nelson Products
American Air Filter Co., Inc.

SOME COOLING and/or dehumidifying is often desirable at night to reduce the temperature build-up caused by a building's thermal lag, to reduce the humidity, and to purge stale air and odors.

While operation of an air conditioning system for maximum efficiency under peak or partial load conditions is fairly well established, there is much less accepted theory on the operation of systems during unoccupied periods in buildings not used around the clock. The alternatives have usually seemed to be: 1) Shut the system down at night, and let the cooling load build up; or 2) Run the whole system intermittently at night to keep space temperatures below the control points. Neither is particularly efficient for most situations.

How much cooling can be obtained at night by operating the fans but not the refrigeration plant of an air conditioning system? How much can the moisture content of the inside air be reduced by the same method?

To find the answers to these questions, night air cooling tests were conducted in an office building in Moline, Ill., for a 12 day period in August 1955. The tests were conducted by W. V. Millman, engineer with our company. The results show that refrigeration for daytime air conditioning can be appreciably reduced in many cases, with analogous savings. In the case of this building, 80 tons of cooling could be accomplished in 4½ hours each night under the test conditions.

The air conditioning system has a 55 ton evaporative condenser-compressor. This system circulates water at the rate of 150 gpm, based on 80 F wet bulb, 35.5 F suction temperature, 48.8 F entering and 40 F outgoing water temperatures. The 38 remote heating and cooling units, with capacities from 500 to 1250 cfm, total 25,500 cfm.

Power requirements of the 38 units total 2.38 hp operating at normal speed, while the compressor, condenser, pump, and circulator in the

(Continued on next page)

NEW SCHOOLS are beginning to reflect higher comfort standards. Optimum classroom environment for comfort and learning requires a year 'round solution in many parts of the country. Many schools built in the future will be air conditioned, even as many today are providing for future air conditioning

Big Summer School Enrollments Dramatize Need for Air Conditioning

WITH summer enrollments increasing for secondary schools, normal schools, colleges and universities, and vocational schools, interest is zooming in air conditioning classrooms.

As an example of the increase in summer school enrollment, Chicago's public school planned for a 1956 summer enrollment of 18,000, a gain of 28 percent over the 1955 enrollment of 14,000 that "swamped" the system in 1955. Even these plans for 1956 were insufficient as close to 20,000 students actually enrolled.

Following the steadily growing use of air conditioned classrooms in the south, such cities as Denver, Colo., Skokie, Ill., and Schenectady, N. Y., are now planning for or furnishing air conditioning in at least a portion of their high school.

The latest addition to Denver's vocational high school, to be opened this month, will be air conditioned. Schenectady has taken heavy year 'round vocational programs into consideration in providing for year 'round air conditioning in the central Core-Techs unit of its new Linton high school. The Niles township (Skokie, Ill.) school board confirmed its future cooling plans in May of this year. The new building is designed to accommodate about 2500 students in the ninth and tenth grades.

Many different plans are being developed and tried to utilize more fully the school facilities during the 12 month period. In proposing a 12 month plan, accountant L. C. J. Yeager, of Louisville, said Louisville and Jefferson County, Ky., could get 33.3 percent more use from their schools without spending $1 of capital outlay. He said, "It is seldom that a business or industry operates economically using its plant and equipment only 75 percent of the time."

refrigeration system require 71 1/3 hp, operating at full capacity. Thus, unit fan horsepower requirements are about 1/30 of the total system load.

The building itself is a two story brick structure with basement. All three floors are occupied and used as offices. Occupied space totals 150,000 cu ft. There is no shade on south, west, and north exposures, and since the building is U-shaped, opening to the south, the south and west exposures are increased.

The room in which the test was conducted is on the northeast corner of the second floor. This room, with least exposure to sun, was selected because it would normally have a lower temperature rise during the night, after system shutdown than would rooms with more exposure. Thus the cooling effect of the system would be minimal.

How System Operates

In summer the cooling units operate on the summer cycle, which is in the mechanical cooling range, using chilled water. In this range the main outdoor air damper is closed, and an auxiliary outdoor air damper is open. This admits 20 percent outside air to pass through the coldest part of the coil for rapid removal of latent heat. Supply valve modulation controls the room air temperature during this operation.

In winter and mild weather periods, the units operate in the winter cycle, which is in the hot water range. In this range the auxiliary outdoor air damper is closed and the main damper modulates from closed, for full heating, to open for 100 percent outside air, for full natural cooling. A built-in contact thermostat automatically indexes the controls from the winter range of operation to the summer range, or the reverse of this, according to the temperature of the water supplied to the unit and the comfort requirements.

Clock Turns On Units at Night

In this test, the units were indexed from the summer chilled water cooling range operation to winter range operation with night air cooling using 100 percent outside air, merely by stopping the chilled water circulating pump. The warming of the water in the header of the coil indexed the unit controls to the natural cooling position automatically. Actually, all that was required was that the units be turned on by a time clock at night without running the chilled water pump.

The recording apparatus used during the test was a six point electronic temperature recording potentiometer, measuring wet bulb temperatures with immersed wicking and blower. Room air and outdoor wet and dry bulbs, and entering water and discharge air temperatures were also recorded. Frequency of damper operations was charted by operation pens on the temperature recorder.

Temperature Difference Varies

Of course, the speed and effectiveness of such a cooling operation would depend on the temperature difference between the outdoor and room air at night and the heat storage characteristics of the structure. Considerable variation was experienced in these wet and dry bulb temperatures during the test period. The time of "turn on" for the fans and units also varied. However, six representative test nights were averaged, with the following results:

- On the average, the room air temperature rose about 6 F above the control point after the mechanical cooling system was shut down at about 8 p.m.
- The greatest amount that the room air temperature rose above outdoor temperature — usually at 6 a.m. — averaged 11 F.
- Temperature difference between outdoor and room air on test nights averaged 7.5 F.

TABLE 1—TEMPERATURE PULLDOWN, hour by hour, as a result of unit fan operation without refrigeration averaged 3.7 F for the typical 4½ hr period

Hour	Temperature differential, F		Hourly rate pulldown	Temperature decrease per hr, F
1st hr	9.5	×	0.258	2.5
2nd hr	7	×	0.091	0.6
3rd hr	7	×	0.044	0.3
4th hr	7	×	0.044	0.3
5th hr (½)	7	×	0.044	0.2
			Decrease in test room temperature:	3.7

Average temperature differential: 7.5 F

Reduce Temperature 3.7 F

Cooling unit fans, on a typical test night, turned on at 2 a.m., reduced the room air temperature an average of 3.7 F during the 4½ hr test period. This cooling was accomplished with the system operation described above, using the fans to introduce a maximum of 100 percent outdoor air, without running the refrigeration system.

The actual hour by hour pulldown of temperature for the typical test night is shown in Table 1.

This cooling rate in the test room, if applied to the other rooms of the building — where, incidentally, the actual rate would be greater due to exposure — would equal 78 tons of chiller operation. This is based on the assumption that the load would be constant for the 24 hr period. The power required to operate the fans to accomplish this cooling would be 2.38 hp × 4.5 hr, or 10.7 hp hr. This is about 1/10 of the power that

TABLE 2—ABSOLUTE HUMIDITY REDUCTION as a result of unit fan operation is shown here for the typical test night. Room absolute humidity approached the outdoor absolute humidity by the time the air conditioning system was turned on

Time	Outdoor absolute humidity, gr per lb	Room absolute humidity, gr per lb
4 p.m., full system on	100	74
8 p.m., system off	88	88
2 a.m., fans turned on	88	90
6:30 a.m., full system on	74	75

would be required to operate the refrigeration system if this load and outdoor conditions existed throughout the period.

The equivalent refrigeration for the building during the test period was calculated from the following:

$$R_t = (Vp\ C_p\ FM)/B_t \quad \ldots\ldots\ldots [1]$$

where R_t = refrigeration tons per hr; V = volume of air, cfm; p = density of air, lb per cu ft at 70 F; C_p = specific heat, Btu per F per lb of air; and F = average temperature difference, F; M = 60 minutes per hr; and B_t = Btu per ton.

Since the product pC_p60, when usually combined, equals (0.075) (0.24) (60), or 1.085, the average tonnage is:

$$R_t = [(25{,}500)\ (1.085)\ (7\tfrac{1}{2})]/12{,}000$$
$$= 17.3 \text{ tons per hr} \quad \ldots\ldots [2]$$

At this rate, the total tonnage for the 4½ hr test period would be 78 tons. This represents sensible cooling only.

Reduces Humidity Build-up

Just as the room air temperature rises above outdoor temperature at night in an unconditioned, unventilated building during the summer, so will the absolute humidity build-up. Within an hour after the system is shut down in the late afternoon, average room and outdoor wet bulb temperatures are equal, with the indoor wet bulb temperature increasing. This is due to re-evaporation from coil surfaces, and from the stored moisture in the building walls, equipment, etc.

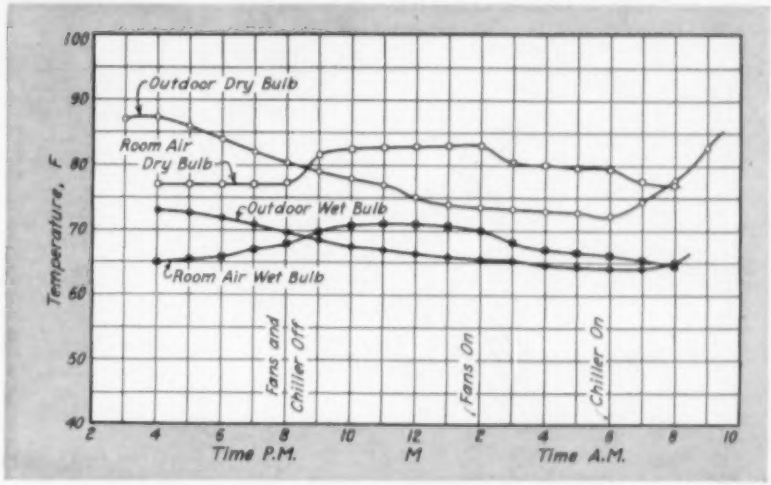
The tests showed that the "natural cooling" operation of the cooling unit fans, introducing 100 percent outdoor air, help to correct this situation, also. The effectiveness of the cooling unit fans in reducing the absolute humidity in the room is shown in Table 2.

The test system reduced the absolute humidity from 90 to 75 grains per lb between 2 and 6:30 a.m. for this typical period. At this rate, the total moisture reduction in the building would be: (15 gr per lb/7000 gr per lb) × (150,000 cu ft building volume/13.65 cu ft per lb dry air), or 23.6 lb of water.

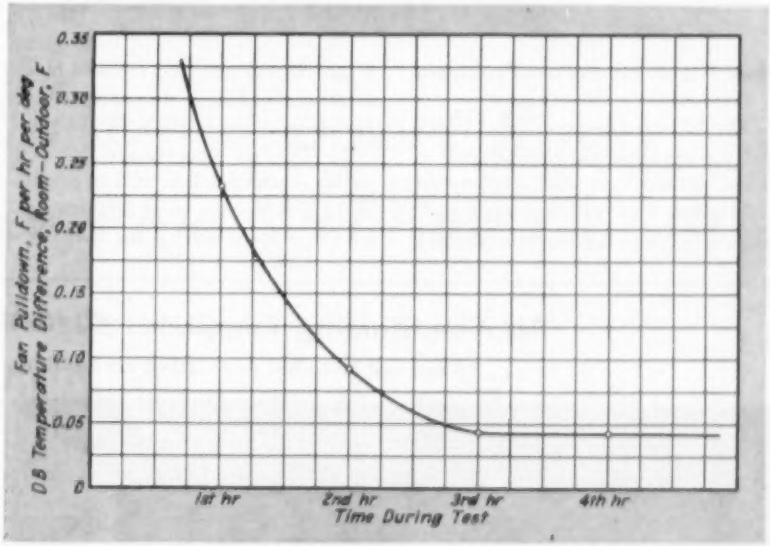
The refrigeration equivalent of this is: [(23.6 lb) (1048 Btu per lb)]/12,000 = 2.06 tons. Therefore, the total amount of refrigeration accomplished by the test system is 80 tons.

This 80 tons of cooling was achieved with the expenditure of 2.38 hp × 4.5, or just 10.7 hp hr of energy. This was all the power required to run the remote unit fans for the 4½ hr test period. Operating the entire system to provide this amount of cooling would take 73.9 hp × (80 tons/55 tons per hr), or 107.4 hp hr — just 10 times the requirement of the test system.

One other advantage of night air cooling is that it purges the building of stale air and odors that are otherwise locked in the building at night. During the 4½ hr night test, with 10.2 air changes per hr, the "natural cooling" operation brought in a volume of air equal to 46 times the original.



3 TYPICAL AUGUST NIGHT conditions shown here are a composite of six nights' results with remote heating and cooling unit fans. A time clock turned the fans and chiller off at 8:00 p.m. and turned the fans on around 2:00 a.m. Night air cooling until 6:00 a.m. reduced room air temperatures appreciably



4 DRY BULB TEMPERATURE REDUCTION with remote heating and cooling unit fans and 100 percent outside air on typical test night is shown here. With 10 F differential between outdoor and room dry bulb temperatures, rate of pulldown in the first hour is 2.38 F; in the second hour, 0.7 F.

TABLE 3—HEAT TRANSFER COEFFICIENTS for the test building are similar to those for average school construction, as shown here

Areas	U-factor, Btu per hr per sq ft per F
Walls, 12 in. brick plus plaster	0.34
Ceiling, built-up roof over reinforced concrete pan construction, with 2 ft attic space, plus acoustic tile	0.30
Windows, single pane, double hung, with venetian blinds	1.10
Average school construction	
Walls, 4 in. brick, 8 in. block no plaster	0.32
Ceiling, built-up roof, plus insulation	0.15
Windows, single pane	1.10
Average of other construction (offices, churches, etc.)	
Walls	0.20 to 0.15
Ceiling	0.15 to 0.10
Windows, double	0.65 to 0.55

Test room areas, sq ft	North	East, shaded
Net outside wall area	98.8	100.7
Window area	56.7	20.8
Ceiling area, total	190	
Window area is 28 percent of total.		

Typical classroom areas, sq ft	
Gross outside wall area	550
Window area	150
Volume, cu ft	7200
Window area is 27 percent of total.	

How Night Air Solves Problems

The following facts observed in the test are applicable in some degree to other situations in similar climates:

1) Room temperature at night rises above the day control point about 6 F, on the average, and remains higher all night. This is due primarily to the thermal lag in the walls.

2) Outdoor temperature falls all night, reaching a low, at 5 to 6 a.m., of 11 F below the room temperature, on the average during the tests.

3) Cooling unit fans, turned on between 12 midnight and 2 a.m., can reduce room temperature almost 4 F, running 4½ hr on an average night, by introducing 100 percent outdoor air.

4) Power consumption of the test system was about 1/10 of that required to achieve an equivalent cooling by running the whole refrigeration and air conditioning system.

5) Added benefits from the test operation were in reducing the humidity of the room — equal to 2.06 tons of refrigeration — and purging stale air and odors from the building with 10.2 air changes per hr.

6) Two factors in the test minimized the actual cooling results and should be pointed out: The test room had a northeast exposure, where room temperature rise would be lowest and indoor-outdoor dry bulb differences at a minimum. Also, the test days were unusually warm, so the drop in outdoor temperature at night was less than might ordinarily be true. Under more normal circumstances, the natural cooling results would be even greater than they were for the test. ⫩

Air Conditioning Completes $3 Million Dream

. . . 30 ton coil installed in existing air handling unit uses well water

DEDICATION of the $3 million headquarters of the Sisters of Mercy in Omaha last year was the completion of a 91 year old dream.

But in the chapel, the new ventilating system seemed inadequate for Omaha's hot humid summer weather, reports Hastings Air Control, Inc.

To provide cooling, a 30 ton coil was installed in the chapel's existing air handling unit and connected to an 80 gpm well. The cooling system is operated during warm weather from 3 a.m. till 9 p.m. and completely cools and dehumidifies the 9000 sq ft chapel. Room temperature is maintained at 70 F, a difference of about 25 F from Omaha's usual 95 F summer heat. Daily cost is estimated at 50c.

The unit uses 100 percent outside air, introduced at the rate of 12,000 cfm. After the well water has served its purpose as a cooling agent, it is used to irrigate lawns and gardens.

The Sisters are now considering air conditioning the cafeteria and gymnasium. ⫩

For inert gas tungsten arc welding of piping for atomic reactors, steam plants, paper mills, chemical plants, and other installations . . .

1 ADDITION OF FILLER METAL from manually held filler wire while manipulating tungsten arc torch with the other hand is slow and cumbersome method of making root pass compared with inserting consumable rings

Consumable Solid Insert Rings Improve Pipe Welding Quality

- **by minimizing human variable welding effects**
- **by giving favorable weld contours that resist cracking**
- **by producing metallurgically sound weld metal composition**

2 CONSUMABLE INSERT RINGS are available in various sizes for different diameters of pipe from 2 to 16 in. Each ring may have two positioner pins to aid welding pipe in fixed position

By Helmut Thielsch

Metallurgical Engineer
Grinnell Co.

THE inert gas tungsten arc welding process is being applied in an increasing degree to the welding of piping materials. Particularly on stainless steel piping this process is being extensively used where quality welds are desired.

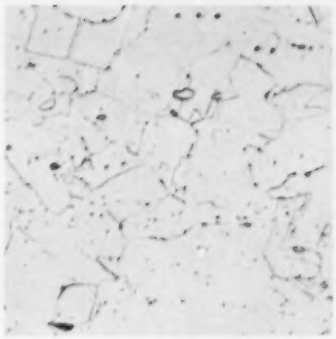
On pipe and tube joints of light wall thicknesses up to about ¼ in., the entire weld is generally made by inert-gas tungsten arc welding. For wall thicknesses exceeding ¼ in., it is usually considered most economical to weld the root pass only by this process and complete the balance of the weld with other welding processes such as manual metal arc welding with covered electrodes.

Base, Weld Metals Differ

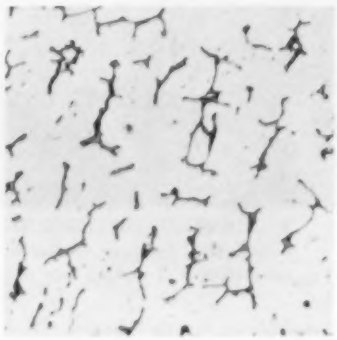
The chemical composition of a piping base metal is established primarily to provide it with certain mechanical, physical, or corrosion resisting properties. Weldability characteristics, if considered at all, are only of secondary concern. On the other hand, the chemical composition of most welding filler metals is balanced with primary emphasis on producing a sound, high quality weld.

The steel making process employed in welding electrode manufacture also permits closer control of the composition range, which is usually considerably narrower than would be practical for the piping base metal where much larger tonnages of steel are involved.

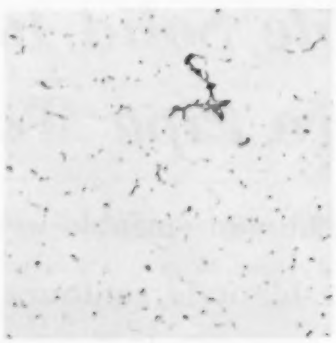
Thus, on many base metals, the fusing together by welding of only the base metal compositions may lead to welding difficulties such as cracking, porosity formation, etc. The addition of filler metal tends to improve weld quality. However, in inert gas tungsten arc welding the addition of welding filler metal from a separate wire which the welder feeds with one hand while manipulating the tungsten arc torch with the other is cumbersome. Since it interferes with welding ease, the welder is more likely to leave areas of lack of penetration, which generally are considered unacceptable as, for example, under the rules of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code. Since some types of serious weld defects are detected only with difficulty during inspection, if they are detected at all, it is extremely important to provide the easiest welding conditions for the welder to produce quality welds.



3 FULLY AUSTENITIC MICROSTRUCTURE typical of Type 347 stainless steel base metal ordinarily produced commercially for piping makes material extremely susceptible to cracking when fused together by welding



4 7 PERCENT FERRITIC MICROSTRUCTURE typical of welding filler metal, shown here, or insert ring mixes with molten part of base metal to overcome cracking tendency of fully austenitic Type 347 stainless steel piping



5 REDUCED CRACKING TENDENCY in weld made with partially ferritic metal ring results when weld deposit retains 1 or 2 percent of ferrite in microstructure, as shown here for stainless Type 347. To produce such weld deposits, ring is composed of 6½ to 8 percent ferrite

Authorities Insist on Rings

One good technique to produce welds of the highest quality is to employ consumable insert rings of proper composition and dimensions. In fact, in piping for atomic reactors, where weld joint "perfection" is of extreme importance, almost all welding authorities concerned with such fabrication agree that acceptable welds in stainless steel piping can be made only with consumable insert rings.

The three primary functions of the insert ring are to:

1) Provide the easiest welding conditions, minimizing the effects of undesirable welding variables caused by the "human" element.

2) Give the most favorable weld contour to resist cracking resulting from weld metal shrinkage and hot shortness, or brittleness in hot metal.

3) Produce metallurgically the

TABLE 1—INSERT RING MATERIALS commonly available are shown here

Insert Ring Type	Composition Type	Nominal Composition						
		C	Mn	Si	Cr	Ni	Mo	Cb
Steel	Steel	0.12	1.0	0.5	—	—	—	—
R11	1¼ Cr — ½ Mo	0.08	0.5	0.5	1.25	—	0.5	—
R22	2¼ Cr — 1 Mo	0.10	0.5	0.5	2.25	—	1.0	—
R5	5 Cr — ½ Mo	0.10	0.5	0.5	5.0	—	0.5	—
304	18 Cr — 8 Ni	0.07	1.5	0.5	19.0	9.0	—	—
304L	18 Cr — 8 Ni, extra low carbon	0.03	1.5	0.5	19.0	9.0	—	—
310	25 Cr — 20 Ni	0.12	1.5	0.5	25.0	20.0	—	—
316	18 Cr — 12 Ni — Mo	0.06	1.5	0.5	18.0	12.0	2.5	—
316L	18 Cr-12 Ni-Mo, extra low carbon	0.03	1.5	0.5	18.0	12.0	2.5	—
347 (A)	18 Cr-8 Ni-Cb, fully austenitic	0.06	1.5	0.5	18.0	10.5	—	0.75
347 (F)	18 Cr-8 Ni-Cb, 5 percent min. ferrite	0.06	1.5	0.5	19.5	9.5	—	0.75

soundest possible weld metal composition of desirable strength, ductility, and toughness properties.

When using consumable solid insert rings, some techniques provide consistently better results than others. The recommendations made here are the results of exhaustive laboratory test evaluations and extensive fabrication experience.

It must be recognized, however, that modification of these techniques may be desirable for particular materials or special fabricating conditions.

Ferrite Weld Prevents Cracking

The insert ring compositions commercially available are listed in Table 1.

For Type 347 (F) stainless steel piping frequently used for atomic reactor piping, the Type 347 ring material is usually preferred. Type 347 stainless steel base metal, as is ordinarily produced commercially for piping, generally has a metallurgical microstructure which is fully austenitic, as shown in Fig. 3. In this condition the material is extremely susceptible to cracking when fused together by welding.

To overcome the cracking tendency, metallurgists employ a so-called partially ferritic welding filler metal of microstructure similar to the one shown in Fig. 4. During welding, the partially ferritic insert ring metal mixes with that part of the base metal which is molten from the welding heat. If the resulting weld retains a few percent of ferrite in the microstructure — see Fig. 5 — the weld usually exhibits a very much reduced cracking tendency. To produce such weld deposits, the insert ring composition is balanced to contain a minimum of 5 percent ferrite. The range usually varies from 6½ to 8 percent.

Standard Sizes Listed

The standard sizes of consumable solid insert rings are given in Table 2 for pipe Schedules 5, 10, 40, and 80. Normally, the insert rings are furnished to match the nominal ID of

TABLE 2—INSERT RING SIZES shown here are standard for the respective nominal pipe sizes

Nominal Pipe Size	Schedule No.†	Nominal Pipe ID	Ring* OD for nominal pipe sizes	Ring* ID for nominal pipe sizes
2	5S	2.245	2.52	2.15
	10S	2.157	2.43	2.06
	40	2.067	2.34	1.97
	80	1.939	2.22	1.85
2½	5S	2.709	2.99	2.62
	10S	2.635	2.91	2.54
	40	2.469	2.75	2.38
	80	2.323	2.60	2.23
3	5S	3.334	3.61	3.24
	10S	3.260	3.54	3.17
	40	3.068	3.35	2.98
	80	2.900	3.18	2.81
4	5S	4.334	4.61	4.24
	10S	4.260	4.54	4.17
	40	4.026	4.30	3.93
	80	3.826	4.10	3.73
5	5S	5.345	5.62	5.25
	10S	5.295	5.57	5.20
	40	5.047	5.32	4.93
	80	4.813	5.09	4.72
6	5S	6.407	6.68	6.31
	10S	6.357	6.63	6.26
	40	6.065	6.34	5.97
	80	5.761	6.04	5.67
8	5S	8.407	8.68	8.31
	10S	8.329	8.61	8.24
	40	7.981	8.26	7.89
	80	7.625	7.90	7.53
10	5S	10.482	10.76	10.39
	10S	10.420	10.70	10.33
	40	10.020	10.30	9.93
	80S	9.750	10.03	9.66
	80	9.564	9.84	9.47
12	5S	12.420	12.70	12.33
	10S	12.390	12.67	12.30
	40S	12.000	12.28	11.91
	40	11.938	12.22	11.85
	80S	11.750	12.03	11.66
	80	11.376	11.65	11.28
14	10	13.500	13.78	13.41
	40	13.126	13.40	13.03
	80	12.500	12.78	12.41
16	10	15.500	15.78	15.41
	40	15.000	15.28	14.91
	80	14.314	14.59	14.22

†Schedule number followed by "S" applies to stainless steel piping only.
*Consumable solid insert rings are normally furnished to match the nominal internal diameter of the pipe. For other pipe sizes and schedules and pipe and tubing of special ID's, and where internal machining has been used, special insert ring sizes are readily produced. Where special ring sizes are desired only the pipe ID has to be specified.

TABLE 3—INSERT RING DIMENSIONS are given here for piping with internal diameters machined in accordance with dimensions of Pipe Fabrication Institute Standard ESI-1956

Nominal Pipe Size	Schedule No.	Machined ID	Ring OD	Ring ID
3	XXS	2.409	2.69	2.32
4	XXS	3.279	3.56	3.19
5	160	4.428	4.71	4.34
	XXS	4.209	4.49	4.12
6	120	5.600	5.88	5.51
	160	5.327	5.61	5.24
	XXS	5.072	5.35	4.98
8	100	7.546	7.82	7.45
	120	7.327	7.61	7.24
	140	7.165	7.44	7.07
	XXS	7.053	7.33	6.96
	160	6.998	7.28	6.91
10	80	9.671	9.95	9.58
	100	9.452	9.73	9.36
	120	9.234	9.51	9.14
	140	8.959	9.24	8.87
	160	8.740	9.02	8.65
12	60	11.725	12.00	11.63
	80	11.507	11.79	11.42
	100	11.234	11.51	11.14
	120	10.959	11.24	10.87
	140	10.740	11.02	10.65
	160	10.413	10.69	10.32
14	60	12.921	13.20	12.83
	80	12.646	12.92	12.55
	100	12.319	12.60	12.23
	120	12.046	12.32	11.95
	140	11.771	12.05	11.68
	160	11.498	11.78	11.41
16	60	14.811	15.09	14.72
	80	14.484	14.76	14.39
	100	14.155	14.43	14.06
	120	13.827	14.11	13.74
	140	13.442	13.72	13.35
	160	13.171	13.45	13.08
18	40	16.975	17.25	16.88
	60	16.646	16.92	16.55
	80	16.319	16.60	16.23
	100	15.936	16.21	15.84
	120	15.553	15.83	15.46
	140	15.225	15.50	15.13
	160	14.842	15.12	14.75

the pipe.

For tubing and pipe sizes and diameters other than those shown in Table 2, and for piping where internal machining has been used, insert rings of special diameters are readily produced in accordance with the following determinations:

Ring ID = Pipe ID − 0.094 in.

Ring OD = Ring ID + 0.375 in.

Where insert rings of special diameters are desired, only the pipe ID has to be specified.

For piping machined internally to the dimensions specified in Pipe Fabrication Institute Standard ES1-1956, the machined ID's and insert ring dimensions are given in Table 3.

ON THE JOB

53 F Well Water Serves Package Units

. . . to condition new shopping center

THE WELL WATER air conditioning system installed in the West Lanes bowlatorium and shopping center in Omaha requires only 22 hp to operate the well pump and the blower motors. Design cooling load for the structure is 80 tons.

The building includes a 24 lane bowling alley, with a 30 ton, 12,000 cfm air conditioning unit; a bar and lounge, with a 10 ton, 4000 cfm unit; a basement party room, with a 7½ ton, 3000 cfm unit; an office, locker room, and barber shop, all served by one 7½ ton, 3000 cfm unit; a penthouse apartment, with a 7 ton, 2200 cfm unit; and six individual stores, each with a 5 ton, 2000 cfm unit.

Each unit is controlled by its own thermostat. The well pump operates continuously, serving all units.

The well water, at approximately 2 gal per ton, enters the units at about 53 F and leaves at 60 to 68 F, depending upon the load.

Relative humidity inside the structure is maintained at approximately 50 to 55 percent under most conditions. No difficulty has been experienced in maintaining this relative humidity well within the comfort zone specifications of the American Society of Heating and Air-Conditioning Engineers.

The system provides up to 100 percent outdoor air to maintain a 75 F temperature during design weather conditions.

2 GAL PER TON is the well water flow required by the 80 ton, multiple package air conditioning system in the new West Lanes Bowlatorium-shopping center in Omaha. Owner Anthony Purcello demonstrates, via "old oaken bucket" and starting button, "how" 53 F water from a central well maintains 75 F temperature in conditioned spaces

Operating costs are anticipated at about $900 for the summer season of 1400 operating hours.

Heating in winter is accomplished by the same units, except that instead of using cold water from the central well, the units use hot water from two 980,000 Btu input, central gas fired boilers. Two pumps circulate hot water constantly. Blowers in each zone operate intermittently, controlled by the combined heating-cooling thermostat for each unit.

The air conditioning installation was made by Hastings Air Control, Inc. ⧺

Engineer Shortage Hampers Industrial Ventilation Progress

Still a child among the engineering sciences, industrial ventilation faces a serious threat in the shortage of qualified engineers because of the lack of formal engineering courses in this field. For it to thrive and attain its rightful stature in modern industry, more than the present nursery training must be made available, says the author.

By K. E. Robinson
Ventilation Engineer
General Motors Corp.

IN THIS MODERN AGE in which we live, it is practically impossible to get away from the effects of industrial ventilation. The food you eat, the clothes you wear, the furniture you sit on, the paper you read, and even the water you drink have known the effects of industrial ventilation somewhere along the line. If all of the industrial ventilation was turned off and not permitted to operate, industry would come to a standstill.

In spite of its importance, industrial ventilation is treated as a stepchild by most designers and consultants and even managers and operators of plants that are so dependent upon it. Why? Perhaps the most understandable reason is that air motion in one form or another has been with us since the beginning of time, and we accept it as an expected thing, as we do our ability to walk.

Another reason might be that it is termed a nonproductive item; and, for those reputed to worship at the shrine of production, anything classified as nonproduction or nonproductive is automatically "untouchable."

1900 Is Ancient History

In spite of the fact that air motion has been with us since the beginning of time, controlled air motion or definite ventilation is relatively new. At the turn of the 20th century, papers were being given as to the efficiencies of heated chimneys vs mechanical fans for exhausting air from buildings. About the same time, an article titled *Necessity of Ventilation* stated: "Variation of the atmosphere in occupied rooms by dust from mechanical operations or other sources must be considered separately from case to case and treated according to the given and required condition." With this one statement the author of the article handled the complete field of industrial ventilation and environment.

Engineers will say that this was a long time ago and that we are doing a much better job today. But are we? We certainly are spending more money, putting in more equipment and sometimes in spite of ourselves getting reasonably good results. But as far as turning out qualified industrial ventilation engineers, we are in about the same position as they were in the early 1900's.

A speaker at one of the early meetings of the American Society of Heating and Ventilating Engineers detailed the need of training engineers for heating and ventilating work. His definition of ventilation was nothing more than supplying and withdrawing air from office buildings, theaters, etc., where industrial ventilation is not part of the vocabulary. The training program he advocated had been developed at a leading university. It was to cover 18 weeks, with the student attending lectures 2 hr per week. In addition, the student was to design complete heating systems for two or three plans furnished him. Questioned some time ago as to industrial ventilation courses offered, this same school said that it did not offer anything.

While a few schools today offer an elective course in industrial ventilation for one term, they are a minority. In a few, it is an option that may be pursued by a member of an engineering school in an undergraduate study. In other schools, industrial ventilation is taught as part of a course leading to the degree, Master of Public Health.

The author writes from a background of more than 20 years' experience in industrial ventilation. As ventilation engineer in the industrial hygiene department of General Motors Corp., he is a consultant to plant engineers of the various GM divisions.

Mr. Robinson is a member of the ASHAE technical advisory committee on industrial environment, chairman of the engineering committee of the American Industrial Hygiene Association, and is on committees of several other societies.

He is also a member of HPAC's board of consulting and contributing editors.

It is questionable if there is any school where a student could major in the subject of industrial ventilation. Generally, the subject is taught because of the influence of people interested in industrial hygiene, not by so-called ventilation engineers.

Although people interested in the heating field have used the word ventilation for many years, industrial ventilation, as we think of it, has been with us for a relatively short time. Rather surprising has been the lack of interest by engineers classifying themselves in the heating and ventilating field. Practically every development involved with hood design, quantities of air to be handled and velocities required have been developed by people in the field of industrial health, since about 1910.

A medical doctor speaking at a meeting of the ASHVE some time ago proposed that this society do something about determining how much air should be handled to control certain operations. To my knowledge, nothing as concrete as that has been done at this time by this organization. In spite of the interest shown by the discussion of the doctor's paper at that time, it was suggested that help might be obtained from the federal government. Although some members objected, it has apparently been left up to the government to come up with the answers.

Begin Developing Standards

The State of New York was perhaps one of the first agencies to issue codes on the subject of ventilation to control industrial processes. For many years, these were the accepted standards throughout the country. They were used by consultants, designers, and industry both in and out of New York as a guide to the type and quantity of ventilation that should be provided. Many of the modern recommendations are based on the original codes.

In the late '20's and early '30's work was done by J. M. Dalla Valle on velocity contours in front of different shaped hoods. This work also has stood the test of time, as it is still considered the fundamental basis for all hood design. Dr. Allen Brandt, when associated with the ASHVE laboratory, worked on the development of information to be used in designing ventilation equipment for process control. This project continued through the '30's as a project of industrial hygiene people; seldom was any thought given to it by any groups officially connected with heating and ventilating.

World War II Spurs Progress

At the beginning of World War II, there was an increased consciousness of the need for control in industry and the federal government sponsored socalled "refresher courses" in industrial ventilation. Articles on the control of certain operations began to appear in a few trade journals, but again invariably the author was someone connected with the control of health problems.

In an effort to carry the message to more industrial plants, the Division of Industrial Hygiene of the State of Michigan assembled a small demonstration showing, by means of smoke, airflow patterns into different types of hoods and how properly designed ventilation systems could control plant operations. A sound movie film was made of this demonstration at the University of Michigan, and since that time, many prints of this film have been made available. The U. S. Dept. of State put 10 different European and Asiatic sound tracks on this film, which has been used throughout the world for educational purposes in conjunction with both the Marshall plan and the Point Four program.

At the same time, this same division in Michigan had assembled a good deal of information together in what they called a ventilation manual. Too, interest revived in the Conference of Governmental Industrial Hygienists, who appointed a new committee to assemble a manual on ventilation. The Michigan group offered their manual. This, with a number of alterations by the committee, was first published in 1951, and the fourth edition was just released in spring of 1956. Copies of this manual have enjoyed a world wide distribution.

Another source of information in this field has been the Industrial Ventilation Conference, first scheduled in February 1951 at Michigan State university. This again was originated by engineers of the Industrial Hygiene Division of Michigan in cooperation with the School of Mechanical Engineering at MSU. This has become an annual affair drawing people from U. S. and Canada. A number of other schools have been held at different times throughout the country, mostly of a lecture type and narrower in scope.

Further reflecting this growing interest in this field are the Industrial Ventilation Symposium scheduled for the 1957 annual meeting of the ASHAE and the large amount of space set aside at the International Heating and Air Conditioning Exposition to be held in Chicago February 25 through March 1, 1957.

Must Train Engineers

But with the difficulty of obtaining formal education in this field, it is evident that a great shortage of ventilation engineers exists. A number of industrial plants today have or would like to have men on their staff assigned to the responsibility of seeing that proper ventilation is installed and maintained. However, men trained in this field are impossible to hire. The result is that much of the work is handled by men entirely unqualified, and often the expenditure of large sums of money results in very little control. A number of plants in the last few years have hired graduate engineers and then have done their best to train them in the field that they might be qualified to handle the ventilation work.

Installations in this field are growing in size every day; the million dollar job is more the rule than the exception. If the field is to advance along with other engineering fields and keep pace with modern industry, every effort must be made by everyone connected with the profession to see that modern ideas are encouraged, tested, and taught to all new engineers entering the field. ≠

The Law and Your Profits

By William Hurd Hillyer

Insist on Written Commitments

Reliance on printed pamphlets and oral assurances cannot substitute for obtaining a written contract, as this heating contractor, a unit heater manufacturer, and a factory owner discovered at the hand of a public utility.

HEATING and air conditioning engineers and contractors, together with their clients, should take nothing for granted when dealing with public utilities, any more than when dealing with private firms. Trouble may arise, even from reliance upon printed rates, as happened in a recent case.

The Freewheeling Trivet Corp. bought a large industrial building in a manufacturing area. As the heating system was manifestly inadequate, a heating engineer recommended that the existing system be abandoned and that complete gas heating be installed.

The Sunrise Gas Co. sent two representatives to inspect the property. In conversation, they advised the trivet concern that gas would be available at the rate of 45 cents per 1000 cu ft. This sounded all right to Freewheeling, who thereupon consulted Thermo Quipment, Inc., a leading manufacturer of gas heating units. The Thermo people assured the trivet maker that their units, using solenoid valves were common in his area and were approved by the Sunrise Gas Co. Thermo's director of sales and engineering visited the trivet plant and recommended proper equipment.

On the basis of this information, the Freewheeling Co. retained a consulting engineer who provided blueprints and proper layout "at great expense." These were approved by the gas company. Freewheeling then placed an order for the 45 required units of various sizes, and a reputable heating contractor was given the job of installation.

Utility Orders Changes

When advised that these units had been purchased, Sunrise Gas, through its local representative, informed Freewheeling that it would "insist" on diaphragm valves in place of the conventional solenoid valves already installed.

"How come?" exclaimed the exasperated triveteer. "Your company has already okayed the solenoid valves, which are used all around here with your approval!"

"Sorry, you'll have to put in the diaphragm type. Official orders."

Thermo's expert engineer joined the protest. After much delay the gas company's local office agreed to accept solenoid valves; but meantime Thermo had gone ahead and ordered the diaphragm valves.

Thermo Quipment had removed the solenoid valves and installed diaphragm valves at a cost of some $500, only to find that all this extra expense was unnecessary. In addition, the solenoid-diaphragm fiasco delayed the whole job more than three weeks.

If Freewheeling, Thermo, and the heating contractor believed at this point that their troubles were over, such fancies were soon dispelled. The heating man took the blueprints to the gas company's local office, where changes were made in the pipe sizes originally scheduled and approved. He proceeded, therefore, to erect pipe of the revised dimensions. After he had done this, the gas company caused a preliminary inspection to be made by the same person who changed the pipe on the original blueprint. Calmly he told the heating man that the pipe sizes, as erected and welded, were wrong. He denied asking for the changed sizes, which were already in place.

Change Pipe Sizes Again

When the hapless heating contractor requested definite instructions as to correct sizes, he was yet more calmly informed that he should revert to the size of pipe as originally specified on the blueprint first submitted for approval. The contractor was forced to dismantle approximate-

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WILLIAM HURD HILLYER, author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. He has an extensive practical legal and financial background.

This series presents actual cases. Naturally, laws vary in different states. All names are fictitious.

ly 200 ft of completed piping and re-erect the originally specified pipe sizes. "This also," to quote Freewheeling, "was a needless expense both costwise and timewise."

Upon completion of the piping and gas unit installation, another gas company inspection was asked for by the owner. He was then commanded to install a second manual gas shutoff valve at each unit, just ahead of the shutoff valve incorporated in that unit. Again, the trivet company complains: "That also was a costly and needless expense in both time and money."

Increase Gas Rate 60 Percent

It would seem as if the woes of building owner, heating unit maker, and heating contractor were by this time complete, but these were but the beginning of sorrows. Sped by Jack Frost, Freewheeling sent a letter to the public utility company, requesting confirmation of the 45 cent per 1000 cu ft gas rate, which had been allotted orally at the inception of the transaction. To the trivet concern as owner, Rate 4 was the governing factor in its decision to use gas heat. This decision was fortified by the position of the gas company's own engineer as well as the qualified consulting engineer hired by Freewheeling. Both of these men had estimated that a volume of 12 million cu ft of gas per season would be used to heat the building. The utility company's printed tariff quoted the 45 cent rate for gas used in excess of 300,000 cu ft per month or 1.8 million per six month season. Nevertheless, after the heating installation was practically completed in the trivet plant, its owner was visited by two men from the gas company's home office with sad news. They announced that their company's head office "recommended" the service rate, which would increase Freewheeling's gas cost by approximately 60 percent.

They tried to convince him that acceptance of this higher rate would be to his advantage. After one year, they went on to say, the account would be reviewed and, if it were advantageous to him they would retroactively rebill him for the entire year at Rate 4 which, under the company's rules and regulations, is subject to an annual minimum charge. When Freewheeling asked why he should pay more for gas meanwhile, they promised to write the main office and get the reasons.

Hearing nothing after a decent interval, Freewheeling phoned the main office and was bluntly told that the company did not want to sell any gas at the 45 cent rate. Since his entire installation and heating program was threatened by implication, he agreed to their proposal but under protest. He could not help feeling, as he afterwards affirmed, that when "all the facts were presented" to the main office, he would get "the proper consideration and relief."

Owner Appeals to Unit Maker

About the middle of November he wrote to a high official of the gas company, setting forth his grievances in detail. He requested an interview for himself, the heating contractor, and Thermo Quipment's director of engineering. There is no record of a reply; but the meter reader was thereafter punctual in his appointed rounds, and Freewheeling had to pay the higher rate with equal regularity.

Year's end brought the usual blizzard, in the course of which the gas service was so bad that the trivet company appealed to the manufacturer of the heating units. Thermo Quipment's vice president came in person and made a survey with tests.

"I took a gas pressure reading at two of the unit heaters," he writes in his report. These had been giving trouble "with the pilot burner and kicking and shutting off the burner gas. I found the following values of gas pressures at Unit B-2 on the first floor" near the end of the gas line supplying the units on that floor.

"1) Ahead of the manual shutoff valve, with the unit not burning or running, the pressure measured 3¾ in. water gage.

"2) At the same spot, with the unit burning and running, the gas pressure measured 3½ in. WG.

"3) Ahead of the burner manifold and on the downside of the pressure regulator solenoid valve and elbow, with the unit burning and running, 2½ in. WG."

Gas Pressure Below Minimum

Practically all gas fired unit heaters, including those belonging to the trivet corporation, were so designed, and the pressure regulator so set, as to operate on 3½ in. WG just ahead of the burner manifold. In this instance the pressure was only 2½ in. WG.

The American Gas Association, said Thermo's vice president, permits a pressure drop of 1 in. WG through the controls and the pressure regulator. Therefore, in order to maintain 3½ in. WG on the burner side of the controls, there should be a pressure ahead of the manual valve of not less than 4½ in. WG. This should be an absolute minimum ahead of the unit for trouble free operation.

"I took another gas pressure reading at the single unit on the first floor which had given some trouble," the equipment manufacturer reported. "This unit is not far from the incoming gas supply near the meter. With no gas burning, and with the unit not running, I again obtained a pressure of 3¾ in. WG ahead of the manual valve."

In point of fact, 4½ in. WG should be the minimum, Thermo's executive said. He voiced the belief that if Freewheeling would talk with the gas people and tell them "these values," they would be "very glad to increase the pressure a little bit" so as to increase the reading to 4½ in. WG ahead of the unit and ahead of the manual shutoff valve. Less than this pressure, the expert made clear, would definitely cause occasional shutoff of the pilot burner relay, exactly as had happened.

Some pressure adjustment must have been made, for there is a lull in the mishaps during the next 14 months. However, no relief was forthcoming as to the "exorbitant" rate, which continued to be billed and paid. At length, his patience ex-

hausted — and presumably, his bank balance depleted — Freewheeling turned the matter over to his lawyers, Messrs. Clearfax & Clearfax. The lawyers wrote a letter to the Sunrise Gas Co. and a carbon copy was sent to the utility commission.

Utility Cites Printed Rules

The gas company, it seems, had reacted to a previous letter from the law firm by proposing to give Freewheeling the benefit of the 45 cent rate retroactive five months, provided he would agree to all terms and conditions of the rate relative to special minimum charges for low load factor purposes. The utility company's proposition had been further tied in with a certain page and section of its general rules.

The relevant paragraph in these printed rules, after laying down certain provisions for "low load factor," closes with the statement that the gas company reserves the right to require "contributions toward the investment" and to establish such minimum charges and facilities charges as may be equitable.

Clearfax & Clearfax were unimpressed by these precepts and provisos. "I repeat," writes the senior partner to the gas company's commercial manager, "you have not justified any such additional charges on the basis thereof. You have not shown any figures or facts to establish such minimum charges. Until you can show us some equitable reason for a charge over and above 45 cents per 1000 cu ft, we resist any billing under Rate 2 and will continue to have you bill us at Rate 4.

Client Resists Higher Billing

"You seek to charge our client," the lawyers complained, with an approximately 25 percent higher rate than is proposed in your pamphlets, which is clearly excessive and exorbitant." Other public utility companies, Clearfax maintained, do not even charge 45 cents per 1000 cu ft. He therefore appealed to the gas company's sense of honor, trusting that it prided itself upon being as efficient as other utility companies in the gas consumer field. Lest this plea fail, the attorneys reminded Sunrise: when their client arranged for the installation of gas heating it was represented to him that the charge would be 45 cents per 1000 cu ft of gas consumed in excess of 300,000 cu ft. "For your company now to continually seek a higher rate is definitely improper," the law firm declared. After stating that the matter had been laid before the utility commission, from whom definite word was presently expected, the letter reiterated in conclusion a determination to resist all billing above Rate 4.

At the end of a year's service, the Sunrise Gas Co. did review the billing to Freewheeling and rebilled from Rate 2 to Rate 4, with the annual minimum charge, and forwarded a check for $1027.63. Later correspondence and conference with the local manager and home office representatives finally resolved the matter. Freewheeling is now being billed at the 45 cent rate subject to an annual minimum charge set in accordance with the rules and regulations.

This result was achieved after 18 months of struggle; but there is no record of compensation for the time-expense losses needlessly incurred by the heating contractor, the unit manufacturer, and the long suffering owner of the building. If these gentlemen had relied less upon printed pamphlets and oral assurance and had insisted on written commitments, they would have saved themselves much trouble and outlay. ⧧

AIR CONDITIONER PERCHES IN AIR

NO SPACE at ground level outside forced installation of this 5 hp waterless condenser on a specially built, elevated steel platform. Unit could not be installed directly in the store or basement because an adequate air supply could not be obtained. Nor could the building roof be used. Refrigerant lines connect condenser with combination cooling coil and fan unit inside

Question of the Month

What's Causing Compressors to Fail?

THE QUESTION, *What's Causing Compressors to Fail?*, was asked previously in HPAC by a reader and is repeated here along with answers that have been received. Other answers for publication will also be welcome.

"Three 30 ton air conditioning units on the 11th floor are used to cool the first floor and basement restaurant by a circulating pump from the units at the compressor.

"Last spring and summer, every week or 10 days some of the suction discs in the compressors would break, so we installed new rings and an oil separator on the discharge line. We also blew out the system to get rid of any oil in the lines. This seemed to help for a while. Then when more load was put on the zone in question, the pulleys on the motors to the compressors were changed to speed them up, suction valve discs began breaking again.

"The compressors are installed for automatic operation, with two thermostatic expansion valves and two solenoid valves. Two new 50 ton thermostatic valves were installed last winter, but with the compressors not in operation yet this season, we don't know if that was the trouble.

"We operate on a temperature of 40 F to the circulating pumps and the suction pressure is 28 in. Hg. The head pressure is 120 psi. An outside evaporator and fan which are water cooled are on the roof.

"We would appreciate any help and advice HPAC readers would be kind enough to send us as to what is causing these failures."—S. C. M.

Valve Disc Failure Caused By Increased Refrigerant Flow to Meet Load Demands

INCREASING compressor speed to meet load requirements increases refrigerant flow rate through the suction valves. With valve area fixed, fluid velocity increases in nearly direct proportion to load. The higher velocity results from fluid acceleration, which induces forces of greater magnitude to act upon the valve assembly. Since force values are not constant, the variations will cause momentary stress concentrations in excess of normal. The effect of variable force amplitude will lead to failure of the valve discs, resulting from the combined effects of exceeding the ultimate strength and fatigue.

It is suggested that S.C.M. discuss the problem with the compressor manufacturer. Maximum inlet velocity recommended by the manufacturer should be compared with those occurring during high load operation. If the difference is appreciable, reduction of refrigerant flow rate or installation of a larger valve assembly is required to overcome these problems.—H. B. WAYNE, Consulting Engineer.

READER ASKS—

"Why Can't Sprinkler Piping Be Welded?"

"I would like to know why sprinkler piping systems are not welded when they are installed. We have been told that welding these pipe joints makes a fire hazard, but we are permitted to weld the steam lines only a few feet away.

"Perhaps another reason for not permitting welded joints in these systems is that it might break during a fire, or could it be that welded piping might have greater restrictions to the flow of water?

"I would like to hear why this situation exists and also if there is a possibility that it will be changed."—P.J.R.

• *YOU ARE INVITED to contribute a question for publication or an answer to a published question. Write: The Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

Liquid on the Head and Liquid Slopover Into Suction Line are Common Causes

THE MOST common causes of broken compressor valves are liquid condensing on top of the head and liquid slopover into the suction line.

Liquid on the head occurs when the compressor is in a space which is sometimes cooler than the evaporative condenser if one is used. If this is the cause, the discharge line from the compressor can be looped down to the floor and then to the evaporative condenser which will trap any condensed liquid.

Liquid in the suction line might be caused by an oversized valve, by wrong superheat, or by the chiller becoming air bound.

One way to prevent liquid slopover into the suction line on startup is to have a marine type hookup. When the thermostat is satisfied, a solenoid drops in the liquid line and the machine pumps down on the low pressure switch. This should prevent any liquid buildup in the chiller.—B. L. CREW, Engineer, Heating and Air Conditioning Dept., State Planters Bank of Commerce and Trust, Richmond, Va.

Suction Valve Breaks Often Caused By Too Much Oil Lifting: Check 3 Points

ALTHOUGH S.C.M.'s explanation of his system is not too clear to me — I would need additional data, of course — I would like to comment as follows. I suppose he is using refrigerant No. 12.

Suction valve breaks are often caused by too much oil lifting. Here are three factors that should be checked:

1) Is there a chance of refrigerant entering the compressor crankcase, mixing and condensing in the lubricating oil when compressors stop? If this is the case, at starting of the units, boiling refrigerant will lift oil into the suction valves and can easily cause breakage.

2) Are compressors forced lubricated? In this case, maybe the pump delivers too much oil and should be adjusted for less oil supply to the compressor parts.

3) If splash lubricated, are compressors running at higher speeds than recommended by manufacturer, lifting and splashing too much oil at cylinder walls?

If alternative 1 applies, an automatic resistance should be built into the crankcase to boil out the refrigerant condensed before the compressors start. This can be easily locked into the starting controls so that units cannot start unless the refrigerant has been boiled out.

According to my experience, oil separators will have little effect on the troubles S.C.M. runs into, because they will eliminate oil in the outer system but not excess oil in the cylinder, which is apparently S.C.M.'s trouble.

S.C.M. mentions that he operates at 28 in. Hg suction and at a discharge pressure of 120 psi. This seems too high a ratio for 12 compressor units. I wonder if there are troubles with the discharge valves too? Such a pressure ratio should give a very low volumetric efficiency and also cause overheating of the discharge valves as well as the suction valves.

I cannot see that the newly installed 50 ton expansion valves may have any effect on the compressors causing the breakage.—RALPH E. CAHN, Engineer, Aire Acondicionado, Ltda., Santiago, Chile. ≠

Equipment Penthouse Has Heating, Cooling Plants

. . . 80 ft above street

THE TREND to boiler-on-roof for commercial structures is well demonstrated by the penthouse heating plant atop the Perpetual Building & Loan Association building, Bethesda, Md.

Here some 80 ft above the sidewalks are two automatic gas fired boilers that have operated a full season, according to the National-U.S. Radiator Corp. Circulators move hot water from these boilers throughout a three zone heating system.

Also, in this rooftop equipment room are the domestic hot water heaters and the air conditioning machinery.

The heating contractor was William H. Gilliam Co. ≠

HPAC DATA SHEET

Controlling A. C. Maintenance

GENERALLY, operation of air conditioning systems is automatic. Often, therefore, little thought is given to maintenance and operation of equipment until the cooling output fails or the unit stops completely. But why wait for a breakdown?

Quarterly inspections, when correctly performed, should keep year 'round air conditioners in operable condition; and twice-a-season equipment checks should be sufficient for equipment used only in summer. In industrial and sandstorm areas, equipment may require more frequent inspection.

The maintenance and operation of air conditioning equipment is an acute problem in many installations. Basically, the problem breaks down into four main parts:

1) Lack of trained personnel.
2) Lack of adequate water and electrical services.
3) Lack of suitable repair shop space.
4) An abnormal annual increase in the number of air conditioners in use.

What Does It Cost?

Of course, air conditioning costs will vary with the application and the type of system, as shown in Table 1.

With package units, open type refrigeration equipment is more vulnerable to trouble than factory sealed or hermetic type equipment. The components requiring most attention are the air handling parts—fans, motors, air filters—and accessories such as louvers, grilles, and dampers. A noisy fan, a broken belt, a defective motor, or a dirty air filter can cause considerable trouble. Faults in control systems often cause difficulties, too.

First Requirement Is Cleanliness

What is the first requirement in air conditioner maintenance? Cleanliness! Transfer of heat from an air cooled condenser or refrigerant compressor cannot be accomplished properly if there is a blanket of dust covering the tubing or fins. Adequate air flow through the air filter is not possible if the free air spaces are clogged with airborne dust.

Use a vacuum cleaner and a dusting brush for cleaning, and don't neglect the accumulations underneath and in corners. Replace throwaway type air filters when normal air flow is reduced to about one-half or when matting appears on the surface of the air filter. A velometer or an anemometer should be used for checking air velocity.

Abstracted from the U. S. Navy's Bureau of Yards and Docks Technical Digest No. 59

There are four safety rules to be remembered about Refrigerants in Air Conditioner maintenance:

Four Safety Rules for Refrigerants

1) Never use toxic or flammable refrigerants in comfort air conditioning systems. Anhydrous ammonia is toxic and flammable, and methyl chloride refrigerant is moderately so; therefore, neither should be used for comfort air conditioning. Most modern units use fluorinated hydrocarbon refrigerants, which are not toxic except when decomposed by a flame. Chilled water is often used as a coolant, particularly in systems for large hospitals and offices; the refrigerants used for chilling the water are generally nontoxic.

2) Never mix different refrigerants in the same system. Before replacing or adding refrigerant, be sure you have the right type refrigerant on hand. Operating characteristics of different types of refrigerants are not similar. A system has to be redesigned before it is satisfactory for use with any other refrigerant.

3) Never allow the refrigerant to become contaminated with moisture, and never fill a refrigeration system until the piping is evacuated, cleaned, and dried free of moisture. Occasionally, crankcase oil will work its way into the refrigerating system. Use moisture indicating devices and refrigerant driers of the silica gel or similar types.

4) Never operate an air conditioner when the refrigerant supply in the system is very low; the evaporator will be covered with insulating frost and no cooling will result. Also, motor failure and compressor faults might occur as a result of nonstop operation of the unit.

After the maintenance program is firmly established, the number of breakdowns should drop sharply. If not, the controlled maintenance inspections, training, or supervision are deficient; and the faults should be corrected. ≡

TABLE 1—COMPARATIVE COSTS given here for three air conditioning systems show that the lower the first cost of equipment installed, the shorter the service life and the higher the maintenance and operating costs

Type of air conditioning equipment	Service life, years	Monthly power costs per ton of refrigeration	Initial cost of equipment per sq ft of air conditioned floor space
Window or package type unit	7.5	$12.00	$2.75
Central chilled water or low velocity air conditioning systems	20	8.00	5.22
Central high velocity air conditioning systems	20	8.00	5.60

Tear out along this line

HEATING, PIPING & AIR CONDITIONING

AMERICAN SOCIETY OF
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Journal Section

The object of the Society is to advance the arts and sciences of heating, ventilating, cooling and air conditioning, and the allied arts and sciences, for the benefit of the general public, to encourage and conduct scientific research, and to cooperate with other organizations having the same or similar objectives.

Analysis of an Air-Conditioning Thermal Circuit by an Electronic Differential Analyzer

By G. V. Parmelee*, P. Vance**, and A. N. Cerny†

This paper is the result of research carried out by the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, at its Research Laboratory located at 7218 Euclid Ave., Cleveland 3, Ohio.

SUMMARY: The concept of the thermal circuit is a valuable tool in the analysis of thermal systems. The thermal system can be described by a set of differential equations easily derived from the thermal circuit. However, the actual solution of the equations has been found to be both laborious and tedious. This paper describes the results of the solution of the thermal-circuit equations as obtained by the use of an electronic differential analyzer. The independent variables, such as sol-air temperatures, were generated by electronic function generators; and the dependent variables, such as heat-flow rates and surface temperatures, were plotted with conventional recording equipment. An analysis of the load components due to a sun-exposed wall, a shaded window, and lighting in a typical office has been made.

THE NEED for making more realistic estimates of the instantaneous loads on air-conditioning systems has encouraged the development of new methods of load estimating. Mainly, the problem is one of taking into account the complex inter-relationship that exists between the outdoor environment with its periodic changes, and the structure with its thermal resistances and capacitances and internal energy sources. The principles of thermal circuits and circuit diagramming have been developed to describe this complex relationship. Analysis of the circuit diagram provides the instantaneous system loads, room surface temperatures and other data needed by designers in sizing equipment and selecting controls.

Several methods have been used successfully to solve air-conditioning thermal circuits. Reference 1 describes circuit principles and a mathematical procedure in complete detail. Hydraulic analogue,[2,3] electric analogue,[4] and differential analyzer methods[5] have also been used recently. This paper demonstrates the use of a standard electronic differential analyzer in solving a practical problem and seeks to serve the following purposes: (1) To demonstrate the principles in setting up problems for solution by this method and to thereby encourage engineers to make

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[2]Exponent numerals refer to References.

use of such equipment, which is coming rather rapidly into common use. (2) To explore more fully the suitability of the analyzer in solving a large number of typical thermal-system problems with the view of putting results in a form for general use by air-conditioning engineers. This would involve systematically varying the circuit parameters. (3) To provide results for a specific problem which may be added to those of others in achieving a more thorough and practical understanding of thermal-system behavior.

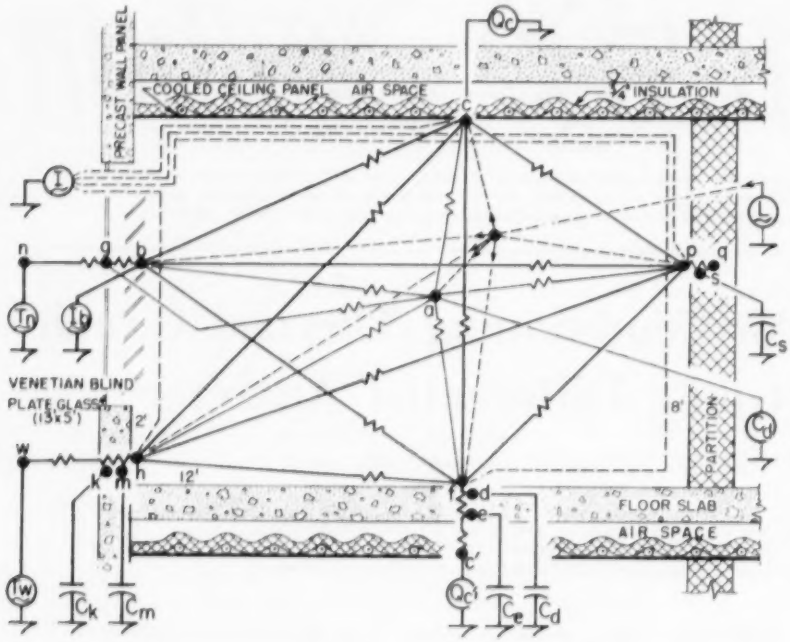

Fig. 1 — Section through room and thermal circuit of illustrative problem. Dimensions — 12 x 25 x 8-ft ceiling

Illustrative Problem

The illustrative problem used as a means of studying the differential-analyzer technique is one of determining the time-variable loads on an office cooling system consisting of a cool-air supply system plus a cooled ceiling panel.

System loads arise from:

1. Solar radiation transmitted through a window provided with an indoor venetian blind.
2. The combined effect of sun and outdoor air in warming the window and blind.
3. The combined effect of sun and outdoor air in warming the exposed wall.
4. A steady lighting load for a portion of the 24-hr period.

Physical Aspects: The main physical features of the thermal system used to illustrate the differential-analyzer technique are shown in Fig. 1. The office to be conditioned is 12×25 ft with an 8-ft ceiling. Adjacent rooms, those above and below, and the corridor are held at the same temperature as the office under consideration. Only the southwest wall, which is 8×25 ft, is exposed. A 13-ft × 5-ft window is centered in this wall and is provided with an inside venetian blind. The suspended metal ceiling has cooling coils attached to the upper side, and these are covered with ¾-in. blanket insulation. Interior partitions are of hollow metal construction filled with sound-absorbing material. Structural details, thermal properties, and the room surface reflectances for short-wave solar and light energy are listed in Table 1.

The Thermal Circuit: The thermal circuit is diagrammed on Fig. 1. Room air is represented by junction point *a*, and is postulated to be at a uniform temperature of 75 F. All surfaces are postulated as isothermal, and their temperatures are denoted as T_c, T_p, etc. Conditions of the problem are further described as follows (with circuit thermal resistances, capacitances, thermal potential and thermal current inputs tabulated in Tables A-1 and A-2 of Appendix A.*)

1. *Weather Conditions*: Solar radiation values are those for a clear atmosphere on

*It is expected that Appendixes A, B, C and D will appear with this paper in the TRANSACTIONS. Until publication in the TRANSACTIONS mimeographed copies of Appendixes may be obtained from the Research Laboratory.

Table 1—Structural, Thermal and Light Reflectance Data for Room Components

Component	Circuit Junction Symbol	Area sq ft	Material	Thickness In.	*k* Btu/(hr)(sq ft)(F/ft)	*w* lb/cf	Cp Btu/(lb)(F)	Light Reflectance
Exposed Wall	*b*	135	light weight concrete plus plaster	4 overall	0.33	100	0.21	0.50
Floor	*f*	300	light weight concrete	4 overall	0.22	75	0.21	0.15
Ceiling	*c*	300	suspended, metal with attached cooling pipes	—	—	—	—	0.70
Sound Insulation	—	300	glass fiber laid on ceiling	¾	0.025	12	0.20	—
Partitions	*p*	392	Steel	20 gage	33	487	0.12	0.15
			and Rock Wool fill	3	0.0225	6	0.2000	—
Window	*g*	65	Plate glass — 0.925 transmittance for sun at normal incidence					
Venetian Blind	*b*	65	White slats (metal) set at 45 deg Ratio slat width to spacing = 1.2					

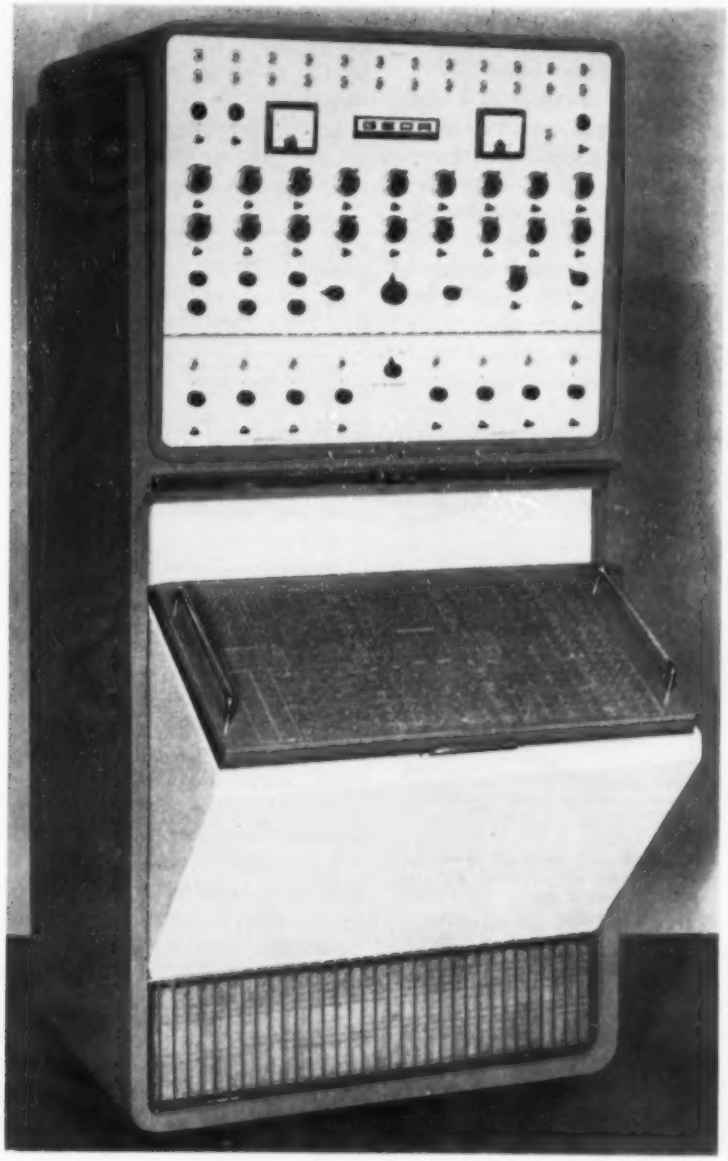

Fig. 2 — The analogue computer

August 1 at 40 deg north latitude (See Table 4, Chapter 13, THE GUIDE, 1955). The outdoor dry-bulb temperature cycle has a 95 F maximum (see Table 8 Chapter 13, THE GUIDE, 1955). Hourly temperatures are listed in Table A-1. The outdoor surface conductance for convection and radiation exchanges combined is 4.0 Btu per (hr) (sq ft) F.

2. *Exposed Wall Branch*: This is represented by the circuit w-h with the surface h in convection exchange with the room air *a*, and in radiation exchange with room surfaces *p*, *c*, and *f*. The cyclic sol-air temperature for the weather side of the exposed wall is represented by the generator symbol designated T_w. The heat capacity of the wall is concentrated in 2 lumps of equal capacitance, C_h and C_w.

3. *Glass-Shade Branch*: This is represented by the circuits n-g and g-b with a cyclic sol-air temperature, T_n, for the window glass, and a cyclic thermal current, I_b, for the solar radiation absorbed by the shade. These shade inputs were computed by methods outlined in Reference 6 and the values are given in Table A-1. The heat-storage capacity of glass and shade are considered negligible for the purposes of this problem. It is further postulated that the window and shade exchange heat by convection with the room air independently of each other (experience seems to indicate that this is true), that they are in radiant-energy-exchange relationship with each other, but that only the shade exchanges radiant energy with the room surfaces. They are treated as *black* surfaces in these exchanges.

Journal Section

4. *Floor-Ceiling Branches*: The ceiling is represented by the heat sink, Q_c, which, in this problem, is assumed to be at a constant temperature of 75 F throughout the 24-hr cycle. The floor circuit *f-c'* ends with the heat sink, Q_c', of the ceiling of the room below. The floor heat capacity is contained in capacitances C_a and C_c.

5. *Partition Branch*: All interior partitions have been treated as one surface at temperature T_p. The resistance branch *p-q* contains half the thermal resistance of the partition with the corresponding thermal capacitance concentrated at the center, *s*. Point *q* is at the midpoint of the partition and is treated as an adiabatic boundary; that is, there is no heat flow between *s* and *q*.

6. *Low-Temperature Radiation Exchanges*: Shape factors and circuit resistances are those used in the illustrative problem of Reference 1 and are listed in Table A-2.

7. *Convection Exchanges*: Values are listed in Table A-2.

8. *Transmitted-Solar-Radiation Thermal Current*: This cyclic energy source is designated *I* in Fig. 1 and was computed for the glass-shade combination. This energy is postulated to leave the shade as if it were a perfectly diffusing source and to be uniformly distributed over the surfaces on which it falls. The amount absorbed by each room surface was determined in accordance with the shape factors of Table A-2 and surface reflectances given in Table 1. Allowance was made for interreflections. The total cyclic quantity of transmitted radiation is given in Table A-1 and the fraction absorbed by each surface by Table A-3.

9. *Artificial-Lighting Thermal Current*: A semi-direct fluorescent lighting system is installed in the office to provide 50 ft-candles at the working level. Data from Reference 7 were used to compute the energy distribution from the lamps and fixtures. This energy amounts to 3.6 watts per sq ft of floor area. The radiation thermal currents, both the long-wave and the short-wave visible, originate in the circuit from source, *L*. A convection current is also included and is connected directly to point *a*. The distribution is given in Table A-3.

Analogue Computer: The computer used in this study is illustrated in Fig. 2.

As a first step in solving the thermal circuit of Fig. 1 on the computer, heat-balance equations were derived for each of the junction points. These equations may be found in Appendix D. The computer circuits were then derived to provide a dynamic re-

sponse (taking scale factors into account) identical to that of the given thermal circuit.

The input voltages and currents analogous to T_n, T_w, I_b and I were introduced into the circuit by means of electronic function generators, and the outputs were recorded with conventional recording equipment.

The technique used in setting up the computer is covered in the book by Korn and Korn listed in the Bibliography.

Computer Results

Solutions in terms of time variable circuit temperatures and instantaneous cooling loads for the thermal circuit shown in Fig. 1 were obtained by means of a standard commercial electronic differential analyzer. These were recorded on a standard six-channel high-frequency-response recording galvanometer and are reproduced as Figs. 3, 4, 5, 6, 7 and 8. Input cycles were repeated until the output curves reached the steady periodic state. All heat-flow rates are in Btu per (hour) (square foot of floor area). The inputs T_w, I, and T_n with I_b were first generated individually so that loads due to each input could be determined separately. For example, with T_w as the input, thermal current generators I and I_b were disconnected and circuit point, n, was connected to ground around the thermal potential generator, T_n. This procedure of treating a linear system, such as the circuit is postulated to be, gives the system temperatures relative to the chosen constant reference temperature. (See Reference 8 for proof.) The resulting cooling loads are the algebraic sums of the thermal currents to point a, room air temperature, and points c and c', ceiling panel temperature.

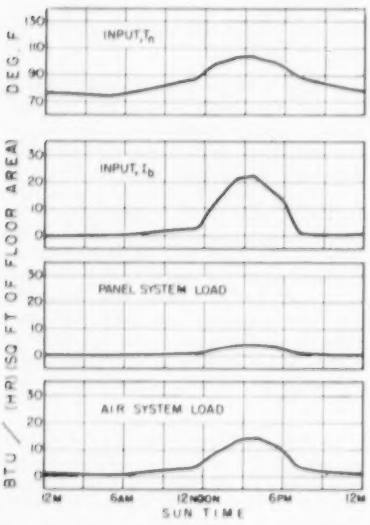

Fig. 3 — Inputs and resultant loads on ceiling panel and air systems due to glass and sunshade

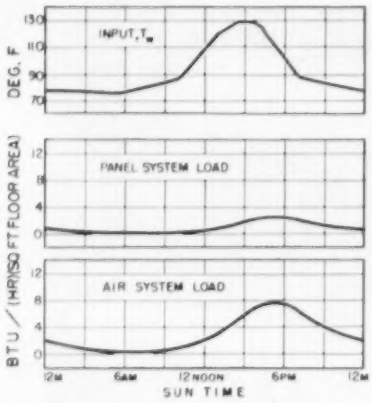

Fig. 4 — Input and resultant loads on ceiling panel and air systems due to exposed wall

Fig. 3 gives the loads on the air system, Q_a, and the ceiling system, $(Q_c + Q_c')$, due only to the sol-air temperature, T_n, for the glass and the solar radiation absorbed by the shade, I_b. It also shows the input curves which were generated electronically as a series of straight-line segments. Comparison of the curves with the values in Table A-1 shows good agreement. Fig. 4 shows the resultant loads due to the sol-air temperature for the exposed wall and also the input curve, T_w. Fig. 5 shows the load components which result from the solar radiation transmitted through the window shade. Only the input curve for the floor is shown, as the others are proportional. Finally, these input functions were generated simultaneously and the resulting temperatures and heat-flow rates are shown in Figs. 6 and 7. Fig. 8 shows load curves which result from the lighting system. This was full on from 8 a.m. to 8 p.m. and off for the remainder of the 24-hr period. Curves A and C were taken from the recorder records and are the panel and air-system loads which result from the long-wave and short-wave radiation from the luminaire warming the walls and floor of the room. Curve B includes the direct load by convection from the luminaire and Curve D includes all radiation which reaches the ceiling panel and is absorbed there, whether it arrives there directly from the luminaire or by reflection from the room surfaces.

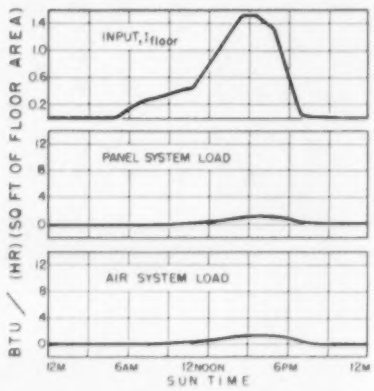

Fig. 5 — Solar radiation transmitted through glass and sunshade and resultant loads on panel and air systems

Evaluation of Differential Analyzer Accuracy

To provide a basis for judging the accuracy of the analyzer results, the circuit diagram was solved for steady-state inputs using the 24-hr average values given in Table A-1 and the thermal currents in Table A-3. This calculation was simplified by the fact that the net heat storage over a 24-hr cycle is zero, and thermal capacitance could therefore be disregarded.

The results of the steady-state computations, together with the 24-hr average values of heat-flow rates and surface temperatures determined from the analyzer curves, are shown in Table 2. It will be noted that agreement between the 2 sets of heat-flow values is excellent except for the load component due to trans-

mitted solar radiation. Inspection of the curves shows that a small zero error in recording could easily account for the error. This could have been prevented by a better choice of scale for this pair of output curves. With inputs combined, 24-hr averages determined by computation and from averages of the analyzer curves, differ by less than 5 percent. Average surface temperatures also compare favorably.

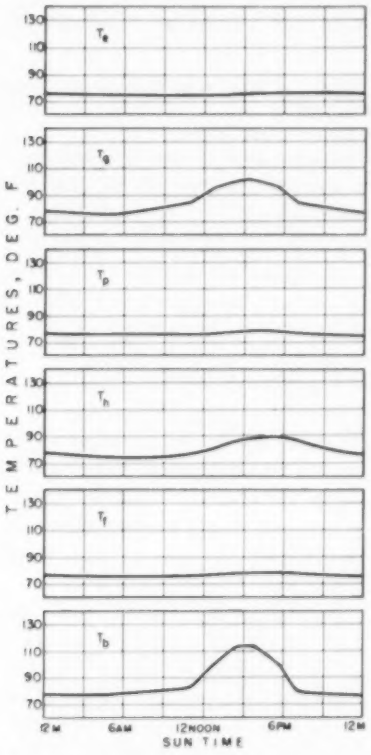

Fig. 6 — Temperatures in thermal circuit resulting from combined inputs T_o, T_w, I_h, and I

Discussion

The results which have been obtained demonstrate that the differential analyzer can be applied to solving practical problems of considerable complexity and give engineering results with satisfactory precision. One should not lose sight of the fact, however, that the problem was set up by applying thermal-circuit techniques and that the analyzer was simply a tool. It should be noted that other operations besides those demonstrated can be carried out with the aid of an analyzer. For example, a constant load could have been imposed on the air system and the resultant surface and room air temperature determined. This load could be cycled so that the room air temperature could be held between predetermined upper and lower limits (see Reference 5). Regimes that could be studied are schedules of air-system loads and of ceiling-panel temperatures. With little additional time, all of the circuit parameters could be varied over the desired ranges, as long as the circuit remains the same. This is perhaps one of the most important features in the use of the analyzer (or a direct analogue). Changes in the circuit form would require alterations in the connections of circuit resistances, capacitances, inputs and operational amplifiers.

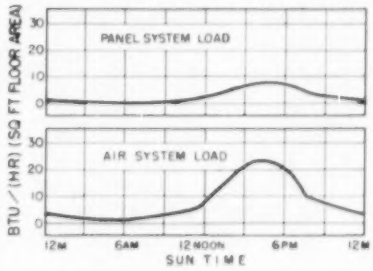

Fig. 7 — Cooling loads on ceiling panel and air systems resulting from combined inputs, T_o, T_w, I_h, and I

One limitation evident from the experience gained with the analyzer is that a circuit of greater complexity, for example, one with more capacitance lumps in the exposed wall branch or with the partition walls subdivided, would require the use of more operational amplifiers. In this particular example, 20 of the machine's complement of 24 were used.

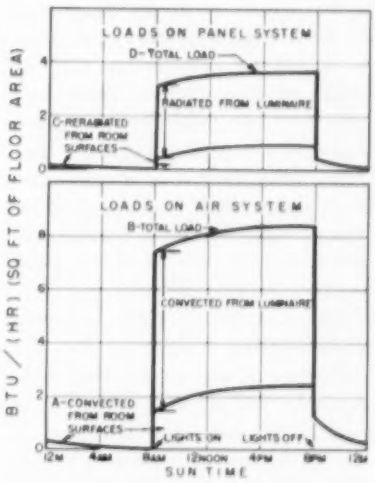

Fig. 8 — Cooling loads on panel and air systems resulting from artificial lighting

Whether or not the thermal capacitance lumping used in this illustrative problems is adequate cannot be answered exactly (see Reference 9). As a check, the periodic heat flow through the exposed wall was computed for the lumping shown in Fig. 1 for constant radiation and convection heat sinks. The exact solution was then computed by H. A. Johnson's[10] charts, and it was found that the results were substantially the same.

Table 2—Comparison of 24-Hr Averages of Analyzer Results with Calculated Results

Comparison of Heat Flow Rates Btu per (Hour)(square foot of floor area)

Component		Analyzer Results			Calculated Results		
		Panel System Load	Air System Load	Total Load	Panel System Load	Air System Load	Total Load
A Glass & Shade	(Fig. 5)	1.07	4.45	5.52	1.18	4.40	5.58
B Transmitted Solar	(Fig. 5)	0.29	0.37	0.66	0.39	0.50	0.89
C Exposed Wall	(Fig. 4)	0.90	2.88	3.78	1.12	2.77	3.89
A + B + C		2.26	7.70	9.96	2.64	7.66	10.30
A, B + C Combined	(Fig. 7)	2.58	7.95	10.53	2.64	7.66	10.30
Lights*	(Fig. 8)	0.47	1.27	1.74	0.42	1.10	1.52

Comparison of Surface Temperatures (Degrees above base temperature at 75 F)

	T_b	T_g	T_h	T_p	T_f
Analyzer	11.7	9.2	5.1	1.7	1.0
Calculated	11.5	9.5	5.8	1.4	0.8

*Loads due to radiation from luminaires which is absorbed by room surfaces but not including direct-to-ceiling load.

Practical Results

Maximum Cooling Loads: Table 3 summarizes the results in terms of maximum loads on the 2 systems and times of peak loads. These data are needed in sizing the components of the 2 cooling circuits. The calculated instantaneous rates of heat gain (by method in THE GUIDE) are also listed in Table 3 for comparison. As solutions of other circuit problems have shown, the ratios of maximum cooling loads to the maximum rates of instantaneous gain for periodically varying inputs are substantially less than unity. In this case they are 0.70 for the transmitted solar radiation and 0.85 for the other inputs. This is due largely to the damping effect of the internal heat storage capacity. It should be pointed out that the choice of this relatively light structure does not bring out the differences between instantaneous gain and cooling load that would be expected with heavy masonry construction. Times of peaks are about one-half hour later than calculated, which is not a significant difference.

The load due to the steadily applied lighting, follows a somewhat different pattern. At the start of the *lights on* period, the load is 85 percent of the instantaneous energy input to the luminaries, but at 6 p.m., and near equilibrium, it has become almost 100 percent. Fig. 8 shows that the load drops rapidly at *lights off* but does not become zero until nearly time for the lights to go on again.

Ceiling Panel Performance: Of practical interest is the performance of the ceiling panel in picking up radiant energy loads. The analyzer results for the lights and transmitted solar radiation at the time of maximum total load are given in Table 4. Calculated results for the 24-hr period are also included. Discussion will be confined to the calculated results, because the analyzer results for the transmitted solar radiation seem to include some zero error. Total radiant pickup was 42 percent of the total transmitted solar load and 57 percent of the total radiant output of the lights. In terms of the total energy input to the lighting system (1.8 watts per sq ft average for the 24-hr period,) the total radiant pickup was 29 percent. These results are dependent upon the assumed distribution of the transmitted solar radiation and the input to the luminaires. The distribution of the transmitted solar energy is believed to closely approximate what would be found in practice. The distribution of the energy input to the luminaire into long-wave and short-wave radiation and convection is admittedly an estimate, but a rational one. This distribution is given in part B of Table A-3.

Table 3—Summary of Peak System Loads, Times of Peaks and Comparisons with Instantaneous Gain

Heat Flows in Btu Per (hr)(sq ft of Floor)

Component	Ceiling System		Air System		Combined System		Calculated Instantaneous Gain[a]		Load/ Gain
	Max Load	Time of Max	Max Load	Time of Max	Max Load	Time of Max	Max Gain	Time of Max	
Glass & Shade, A	3.5	3 pm	14.5	3:30 pm	18.0	3:30 pm	21.3	3 pm	85
Transmitted Solar, B	1.0	3:30 pm	1.4	3:30 pm	2.4	3:30 pm	3.4	3 pm	70
Exposed Wall, C	2.6	5 pm	7.8	5 pm	10.4	5 pm	12.2	5 pm	85
A, B & C Combined	7.2	4:30 pm	23.0	4:15 pm	30.2	4:15 pm			
Lighting: Start	3.1		7.4		10.5		12.3		85
Equilibrium	3.7	6 pm[b]	8.4	6 pm[b]	12.1	6 pm[b]	12.3		98

[a]Method used in THE GUIDE.
[b]Approximate time of equilibrium.

Table 4—Components of Radiant Energy Load on Ceiling Panel at 75 F

Loads are in Btu/(hr)(sq ft of floor)

Transmitted Solar Radiation	At 3 p.m.[a] Load	%	24-hr Average[b] Load	%
Total Transmitted	3.42	100	0.93	100
Direct to panel	0.56	16	0.16	17
Re-radiation to panel	0.44[c]	13	0.23	25
Total to panel	1.00	29	0.39	42
Radiation from Luminaires				
Total Radiant Output	6.30	100	3.15	100
Direct to panel	2.75	44	1.38	44
Re-radiation to panel	0.90	14	0.42	13
Total to panel	3.65	58	1.80	57

[a]Analyzer results. [b]Calculated results. [c]Chart record value = 0.56.

Table 5—Changes in Load Distribution and Room Surface Temperatures caused by a Decrease of One Degree in Ceiling Panel Temperature

Reduction in Room-Surface Temperatures, Degrees F			
Floor	0.33	Shade	0.18
Partitions	0.27	Glass	0.03
Exposed Wall	0.19		
Changes in Load Distribution, Btu/(hr) (sq ft floor area)			
Reduction in air system load due to reduction of room surface temperatures			0.71
Reduction in air system load due to heat convected to panel			1.10
		total reduction	1.81
Increase in Panel System Load, Btu/(hr) (sq ft)			
Increase in panel system load due to net increase of radiation exchange			0.80
Increase in panel system load due to heat convected to panel			1.10
		total increase	1.90
Increase in total cooling load 1.90 − 1.81 = 0.09 Btu/(hr) (sq ft)			

Note that the results given in Table 4 are for a panel temperature of 75 F, which is the same as the room air temperature; hence there is no convection gain by the panel. In actual practice, however, an exchange will take place between the panel and the supply air, which must be introduced at a temperature below that of the room air. This exchange will be influenced by the manner in which the air is introduced. This is a complex problem beyond the scope of the illustrative problem. However, research on this point and also on the matter of energy distribution from luminaires has been carried on at the ASHAE Research Laboratory as part of the panel heating and cooling program and will be reported soon.

The effect of operating the panel at a different temperature can be determined from the steady-state solutions of the circuit equations. (See Appendix C.) If it be assumed that convection conductances for panel and room surfaces remain unchanged, each degree decrease in panel temperature will increase the

panel load and decrease the air-system load by constant amounts. Room-surface temperatures will also change by constant amounts. These changes are summarized in Table 5. Note that there is a small increase in the total load. This results from the fact that the temperature of the radiant environment seen by the exposed wall and window is lower. Note also that a one-degree reduction in panel temperature would cause the total air-system load to become negative during the night if both systems were kept in continuous operation. This would require warm rather than cool air to be supplied to the space.

CONCLUSIONS

1. The electronic differential analyzer with its associated input generators and recorders was found to be capable of solving a complex thermal-circuit problem with an accuracy entirely suitable for making detailed analyses of the behavior of air-conditioning thermal systems, expressed in the form of thermal-circuit diagrams. The combination of the thermal-circuit technique and the computational ability of a differential analyzer showed itself to be a powerful tool in solving the complex air-conditioning thermal problems. It is regrettable that the electrical circuit analogue is not as systematically applied to heat-transfer problems as it has been applied, in the last decades, to mechanics, hydraulics and acoustics. In heat-transfer investigations, partial differential equations are always involved, and with usually irregular boundary conditions, these problems are mostly unsolvable. Thus the thermal circuit technique with the aid of a differential analyzer could be an invaluable help.

2. The analyzer is suitable for handling systems of greater complexity, but additional operational amplifiers would be needed. It is evident that cost must place a practical limit to the number which could be used. Limitations are closely related to the fineness of the capacitance lumping required. Though there has been as yet no rational way of determining the lumping requirements for any given problem, the question of the necessary minimum number of lumps and of their most effective distribution along a circuit branch was recently investigated (see References 9 and 11) and substantial progress was made.

Acknowledgment

The cooperation of the Goodyear Aircraft Co. and of Charles Morell in making equipment available for this study is acknowledged with thanks.

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The President's Page

Our 63rd Chapter

The charter meeting of a new chapter is always an enjoyable and memorable occasion, as it brings into culmination many months and sometimes years of effort on the part of several individuals, who have successfully brought together a group of qualified persons who have decided that they would like to further the basic objectives of the Society.

Such was the scene in Austin, Tex. on the evening of July 19, when 43 members of the Society were granted a charter as the 63rd chapter. As a tribute to the energetic group who sponsored the formation of the chapter, representatives from nearby chapters in Dallas, Houston and San Antonio travelled great distances to add their personal well wishes to the new chapter.

It was gratifying to have Past Pres. Reg. F. Taylor present to deliver an inspiring address on The Chapter's Role in Society Operations. When Mr. Taylor journeyed to Texas a few years ago, it was interesting to have him relate how Dallas was a focal point for the development of a Society chapter, and how members in nearby cities travelled great distances to attend meetings. Charters were first granted to chapters in Dallas and Houston, and then as interests developed in other cities, local groups formed chapters in San Antonio and Lubbock.

With the chartering of the Austin group as a fifth chapter, Texas now ranks with Ohio, leading the states in number of chapters. At the June 17 meeting of Council in Washington, D. C., a new charter was granted to a group in El Paso; so early this fall, the state of Texas will have the unique distinction of having six chapters of the Society within its borders.

Regional Director D. M. Mills participated in the charter presentation and outlined The Value of Chapter Membership, in which he stressed the value of member participation and the personal satisfaction gained in contributing to ASHAE objectives which in the larger sense bring benefits to all mankind.

Although many individuals are always responsible for the development of a chapter, the following were honored as being the first officers of the Austin Chapter:

President — B. E. Segall, Jr.
Vice President — A. C. Lagow
Treasurer — P. R. Sisler
Secretary — J. L. Rea, Jr.
Board of Governors — F. B. Frazee, D. F. Schuett, I. W. Wilke

In accordance with customary precedent, I had the honor of presenting the charter, and on behalf of the previously chartered 62nd chapter in Northern Alberta, with headquarters in Edmonton, Canada, presented also a beautifully engraved gavel to the newly installed President.

With the natural and inevitable growth of heating, ventilating and air conditioning, we all feel sure that the Society will continue to develop in strength and stature. The enthusiasm manifested by the Austin Chapter members at their charter meeting made all of us confident they will contribute substantially to this growth.

John W. James

President
AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS

Relation of Lighting to the Cooling Load

Report of Joint *IES*-ASHAE Committee

For some years a joint committee of the *Illuminating Engineering Society* and ASHAE on Lighting and Air Conditioning has been studying the relationship between lighting and the various factors that enter into air-conditioning. Its report*, now available, is entitled

A Study of the Thermal Aspects of the Lighting System, Part I — Its Relation to the Cooling Load

and is dated April 25, 1955 (revised June 1, 1955).

The report covers 3 projects which the committee set up, namely: (I), compilation of a bibliography; (II), solicitation from members of the two societies of specific questions needing answers, and preparation of suitable answers to them; and (III), preparation of a list of needed but lacking data obtainable by laboratory research.

Of these 3 projects, part (II) is presented here substantially in full but rearranged somewhat in form and sequence, and shortened to some extent.

The joint committee solicited questions from members of the two societies and prepared answers intended to convey the requested information in useful and approved form. This same method of *Questions* and *Answers* is used in the report, and here also under the subtitles

II (a) — Light Sources and Lighting Practices.
II (b) — Cooling Systems and Their Design.

II (a) — Light Sources and Lighting Practices

Question: When the air-conditioning engineer makes calculations to determine the design summer cooling load, what are the total wattages for the various types of fluorescent lamps and their auxiliary equipment?

Answer: The total wattages are as indicated in Table 1.

Question: It is sometimes possible to reduce the connected wattage (and thus the design cooling load) *or the radiant heat (and thus the feeling of discomfort) while maintaining the* design light level. *In this connection what is typical distribution of radiant and conducted-convected energy from filament lamps and fluorescent lamps?*

Answer: The percentage distribution of energy of two typical white fluorescent and incandescent filament lamps is as stated in Table 2.

Question: Fluorescent lamps are being used to a greater and greater extent in commercial, institutional, and residential buildings where air conditioning and ventilation is also being more widely used. What effect is there on light output and ballast life when streams of conditioned air as low as 50 F or as high as 150 F are directed over the lamps at various velocities up to 900 fpm?

Answer: The light output of a fluorescent lamp is influenced by the lamp temperature which is in turn affected by the temperature of the surrounding air, movement of air and the degree to which the lamp is enclosed by the luminaire. The curves on Fig. 1 show the effect of ambient temperature on the light output of bare fluorescent lamps for various rates of air movement. These data were taken in a room cooled to specific temperatures where air movement was accomplished with circulating fans. Some judgment will have to be exercised where the air surrounding the lamps is a mixture of room air and air from a hot or cold duct.

The temperature of the air surrounding a fluorescent luminaire not only will influence the light output from the lamps but also may have a direct bearing on the life expectancy of the ballast. Ballast specifications state definitely that *the ballast and lamp combinations covered by this specification normally are intended for use in room ambient temperatures of* 50 *to* 105 *F.* Where luminaires or ballasts may be required to operate under conditions that fall outside these limits, a thorough investigation of the resulting ballast and/or lamp temperatures should be made in a mock-up of the proposed arrangement before acceptance for installation.

The three families of curves are for heavily, medium, and lightly loaded lamps (arc watts per square inch of bulb wall area). Typical lamps for each of the three loadings are listed on Fig. 1.

Question: Why are ballasts necessary for fluorescent lamps?

Answer: Ballasts are required to provide sufficient voltage for lamp starting and to limit the current through the lamp to the proper value. If a fluorescent lamp were started without a ballast or resistor, it would immediately destroy itself, as the characteristics of the lamp would cause it to draw more and more current until it quickly failed.

*The report in full, in the form of a mimeographed pamphlet, may be obtained by writing ASHAE Headquarters Office, 62 Worth St., New York 13, N. Y.

Journal Section

Question: Is it practical to place ballasts at some central location where they do not affect the cooling load?

Table 1 — Wattages of Various Types of Fluorescent Lamps and Their Auxiliary Equipment

Nominal Watts	Length, inches	Diam, inches	Operating Current, ma*	Watts Consumed		
				Lamp	Ballast	Total
Preheat Starting Lamps						
20	24	1½	370	19.6	4.5	24.1
30	36	1	355	30.0	9.0	39.0
40	48	1½	425	39.6	8.8	48.4
85	60	2⅛	1620	84.0	17.5	101.5
90	60	2⅛	1550	90	17	107
100	60	2⅛	1520	101	16	117
Rapid Starting Lamps						
40	48	1½	430	39.5	9.0	48.5
Instant Starting Hot Cathode Lamps						
	42	¾	120	18	8	26
			200	25	10	35
			300	33	12	45
40 (bipin)	48	1½	425	40	11-15	51-55
	48	1½	427	38	11-15	49-53
40 (low brightness)	60	2⅛	420	40-43	11-14	51-57
	64	¾	120	27	11	38
			200	37	14	51
			300	51	18	69
	72	1	120	26	11	37
			200	37.5	14	51.5
			300	51	18	69
	72	1½	425	55	14-16.5	69-71.5
	96	1	120	34	14	48
			200	49	14	63
			300	69	21	90
	96	1½	425	73	16-20	89-93
Cold Cathode Lamps						
(type LP)	96	1	120	43	8	51
(type HP)	96	1	100	42	11	53

*ma indicates milliamperes

Answer: In some instances it is practical to place ballasts at some central location where they do not affect the cooling load adversely. With some extra initial costs in wiring, the slimline type or 40-w instant start type are often installed with a central panel for ballasts located elsewhere. This will reduce the wattage dissipated at the luminaire by approximately 20 percent. Small offices, refrigeration rooms and like places can be advantageously wired this way. In view of the additional wiring costs, the economics of each individual application would have to be considered.

Question: What is the effect of high temperatures on fluorescent lamp ballasts?

Answer: The life of fluorescent lamp ballasts is closely related to the temperature at which they operate. High temperature is unquestionably a primary cause of reduced ballast life. About 20 percent of the input watts to the luminaire results in ballast heat. If this heat is not dissipated rapidly enough the ballast will become overheated. This will cause the components in the ballast to deteriorate and the ballast life will be shortened.

Table 2 — Typical Energy Distribution of White Fluorescent and Incandescent Filament Lamps

	40-watt White fluorescent	500-watt Incandescent filament
visible radiation (light)	16.5%	12 %
invisible radiation	37.5%	73.8%
Total radiated energy	54.0%	85.8%*
heat by convection and conduction	46 %	14.2%
	100.0%	100.0%

*Typical of all filament lamps (100-1000 watts).

Question: Is there any advantage of using fluorescent lighting over filament lighting from an air cooling point of view? How about mercury lighting?

Answer: Fluorescent lamps and mercury lamps offer a definite advantage over incandescent filament lamps from an air cooling viewpoint. Due to their higher luminous efficiency a lighting level 2 or 3 times higher is possible for the same air cooling load.

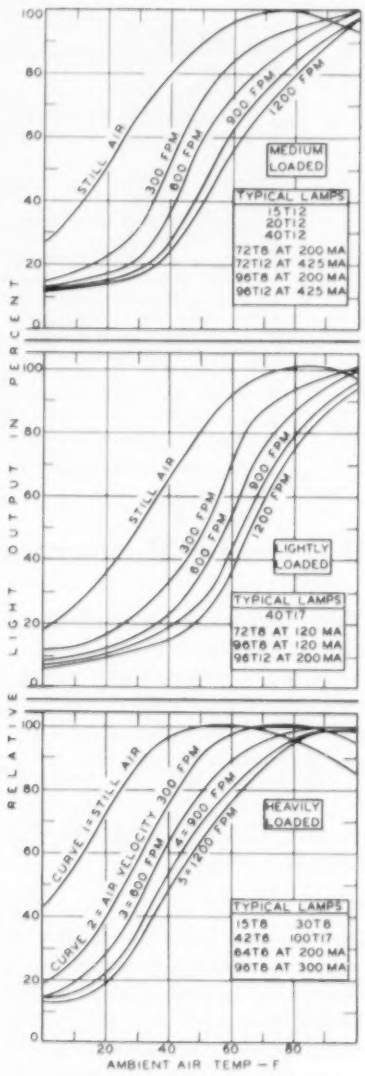


Fig. 1 — Effect of ambient air temperature and air movement on the light output of bare fluorescent lamps (lamps located directly in air stream) (MA = milliamperes).

Question: What are some of the economic considerations in using daylight as compared with electric lighting (from a heating and cooling point of view)?

Answer: Some of the factors that should be considered are heat loss or gain from windows and electric lighting, time of day area is used, ori-

entation of building, geographical location of building, and degree of control of light sources.

Question: What is meant by the efficiency of an electric light?

Answer: The *efficiency* of an electric light source is defined as the light output (lumens) divided by the watts input to the lamp, and is generally expressed in lumens per watt (LPW).

Where auxiliary equipment is required, the overall efficiency is decreased by the power loss in the equipment.

Question: What is the possibility of increasing the efficiency of incandescent filament lamps so less heat is produced in the room while providing a desired level of illumination?

Answer: Any big improvement is not probable unless a new filament material is discovered which is more suitable than tungsten. The efficiency could be somewhat improved by using krypton gas but for most lamps this is not economical.

The higher the filament temperature, the higher the efficiency and the shorter the life. To get satisfactory lamp life it is necessary to operate the filaments at temperatures well below the melting point.

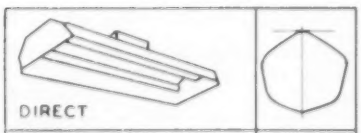
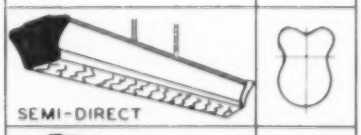
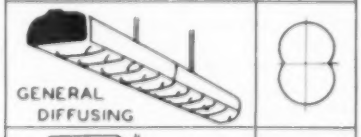
The maximum theoretical efficiency of a straight tungsten wire in vacuum at its melting point (3655K) is in the neighborhood of 53 LPW. The highest efficiency commercially practical is in the order of 34 LPW. This is obtained in some lamps designed for special applications and they necessarily have short life. General service lamps are currently available at an efficiency of approximately 3 lumens per watt for the 10-w lamps and increasing up to 22 LPW for the 1500-w lamps.

Question: Similarly, what are the chances of further improvements in fluorescent lamp efficiency?

Journal Section

Answer: Very good. For the past 10 years, there has been a steady improvement in both the brightness and lumen maintenance of fluorescent lamps. In 1946 a T-12 white lamp of infinite length would have had an efficiency of 70 LPW. Today a similar lamp would have an efficiency of about 80 LPW. There is no theoretical reason why this is the ultimate which can be obtained. Continuing improvements in phosphors and lamp processing will undoubtedly permit lamps to be made consistently at much higher levels than those currently available. Improvements in lumen maintenance are also being obtained so that maintained brightness levels are higher and should continue to improve. Fluorescent lamps are currently available at an efficiency of approximately 65 LPW for the 40-w white lamps. When the wattage consumed by the ballast is added to the

Table 3 — Approximate Heat[a] Emitted from Typical Fluorescent Luminaires Installed in Representative[b] Rooms

(Five usual luminaire types — based on percentage of light emitted above and below the horizontal)			Btu per hr[a] per footcandle per sq ft floor area					
			Large Rooms, Over 2500 sq ft		Medium Rooms, 500 to 2500 sq ft		Small Rooms, Under 500 sq ft	
Type of Luminaire used	Percent of Light		Ceiling Height		Ceiling Height		Ceiling Height	
	Upward	Downward	14 ft or more	Under 14 ft	12 ft or more	Under 12 ft	12 ft or more	Under 12 ft
 DIRECT	0 to 10	90 to 100	0.25	0.19	0.25	0.20	0.35	0.26
 SEMI-DIRECT	10 to 40	60 to 90	0.28	0.24	0.30	0.25	0.42	0.32
 GENERAL DIFFUSING	40 to 60	40 to 60	0.33	0.26	0.35	0.27	0.57	0.40
SEMI-INDIRECT	60 to 90	10 to 40	0.48	0.37	0.52	0.39	0.80	0.57
INDIRECT	90 to 100	0 to 10	0.50	0.37	0.55	0.40	0.90	0.62

[a]These approximate values include the B.u from auxiliary equipments and can be used for Mercury as well as for Fluorescent systems. For filament lamp installations, the values should be doubled.
[b]With 75 percent ceiling and 50 percent wall reflection of light.

wattage of the lamp, the overall efficiency is in the order of 54 LPW.

Question: What is the difference between hot and cold cathode fluorescent lamps and do the differences affect the heat produced per unit of light emitted?

Answer: The hot-cathode lamps contain electrodes which usually are coiled coil tungsten filaments coated with one or more of the alkaline earth oxides. By suitable circuit arrangements these cathodes can be heated to a good electron emitting temperature before the arc is struck or they may be required to act momentarily as cold cathodes until heated by bombardment after the lamp is started. Lamps using these cathodes may be designed to carry rather heavy currents (1 to 2 amp) with low voltage drop (18 volts) at the electrodes. Unless the cathodes are kept at the proper temperature by means of an external heating circuit they do not withstand frequent starting without correspondingly shorter life.

The cold-cathode lamps use electrodes of cylindrical form which may be coated on their inside surfaces with electron emitting materials. These cathodes operate at temperatures below that necessary for satisfactory thermionic emission and therefore the lamps are limited to low current densities. The electrode drop in these lamps is relatively high (105 volts) but they are not subject to short life as a result of frequent instant starting.

The only differences in the behavior of the 2 types of lamps are those imposed by the cathode characteristics as outlined. Otherwise their lumen output and lumen maintenance are the same for the same bulb size, phosphor, and conditions of loading in amperes per unit area of phosphor surface.

The relative lamp efficiencies vary between 31 and 46 LPW for cold cathode and between 37 and 55 for hot cathode.

Question: What effect does ambient temperature, higher or lower than normal room temperature, have on incandescent filament lamp life?

Answer: Unlike fluorescent lamps, the light output of an incandescent lamp is relatively unaffected by changes in ambient temperature. Likewise, natural changes in ambient temperature (that is, from winter's lowest to summer's highest temperature) have little, if any, effect on incandescent lamp life. Operation of the usual type of incandescent lamp in enclosures where the increase in ambient temperature causes the base temperature to exceed approximately 345 F may result in loosening of the base or melting of the lead-in wire solder.

Lamps with mechanical bases or bases employing high temperature basing cement will withstand approximately 390 F. For lamps where base temperature is not a factor to be considered, temperature of the glass bulb is the limiting factor. The usual type of ordinary soft glass as found on standard general lighting service lamps should be operated under conditions where the glass does not exceed 700 F, while the maximum for the various hard or boro-silicate type bulbs ranges from 885 F to 975 F.

Question: Is there a quick way for the air conditioning designer to approximate the heat load from electric luminaires for purposes of preliminary air conditioning estimates — based say on the approximate level of illumination and type of

Table 4 — Levels of Illumination-Good Current Practice[a]

Area	Foot-Candles Maintained in Service
Interior Lighting[b]	
Assembly	
Rough	20
Medium	50
Fine	100
Extra Fine	500[c]
Auditoriums	10
Banks	
Lobby	20
Cages and offices	50
Barber shops and beauty parlors	50
Dance halls	5
Drafting rooms	50
Homes	
General lighting	5
Study	40
Sewing (occasional)	40
Hospitals	
Emergency room, general	50
Nurseries, general	20
Delivery room	50
Surgery, general	50
Hotels	
Lobby	20
Dining room	10
Guest rooms	30
Inspection operations	
Rough	20
Medium	50
Fine	100
Extra fine	200[c]
Offices	
Difficult seeing tasks: auditing and accounting, business machine operation, transcribing and tabulation, bookkeeping, drafting, designing	50
Ordinary seeing tasks: general office work (except for work coming under *Difficult seeing tasks*), private office work, general correspondence, conference rooms, active file rooms, mail rooms	30
Casual seeing tasks: inactive file rooms, reception rooms, stairways, washrooms, and other service areas	10
Simple seeing tasks: hallways and corridors, passageways	5
Professional offices	
Waiting rooms	20
Consultation rooms	30
Examination rooms (supplementary illumination)	100
Dental chairs (supplementary illumination)	200
Restaurants, lunchrooms, cafeterias	
Dining area	10
Food displays	50
Kitchens	20
Store interiors	
Circulation areas	20
General merchandising areas	50[d]
Show cases, wall cases, open counter displays	100[c]
Feature displays	200[c]
Stock rooms	10
Welding	
General illumination	50
Supplementary illumination	1000

Note: Material in this table is abstracted from a much more extended table in *IES Lighting Handbook*, 2nd Edition, 1952, published by *Illuminating Engineering Society*, New York, N. Y. This handbook is revised periodically.

[a] Although most of the levels shown are *IES* approved (1951), the composite table has not been submitted for official approval.

[b] On task or 30 in. above floor level unless otherwise indicated.

[c] Supplementary luminaires often are used in combination with a general lighting level of not less than 20 ft-c to provide the level required on the work.

[d] Range: 30 to 70 ft-c.

luminaire the IES *engineer intends to use in his lighting design?*

Answer: Yes. For the size of room under consideration one can use a value such as given in Table 3 as approximate Btu generated per hr per footcandle per sq ft of floor space from a fluorescent or mercury lighting system employing one of the 5 usual types of luminaires. This value multiplied by the sq ft of floor area in the room and by the recommended footcandles from Table 4 will give the approximate heat load from the lighting system. This assumes that 100 percent of the generated Btu become a load on the cooling system.

As indicated by the note to Table 3, all values should be doubled for filament lighting systems.

II (b)—Cooling Systems and Their Designs

Question: For practical purposes, should the illuminating and air-conditioning engineers assume that 100 *percent of the wattage consumed by luminaires be included in the design cooling load of an air-conditioned building?*

Answer: It is present practice to assume that the instantaneous load on an air-cooling system due to lighting is equal to 100 percent of the rate at which electrical energy is supplied to the lighting system. It is recognized, however, that a portion of the total energy output of a luminaire is in the form of radiant energy and that part of this energy is stored in the structure of a building by raising its temperature. Hence, the instantaneous cooling load may be less than the instantaneous power input to the lighting system. However, because of lack of data on this heat storage effect, conservative design requires the practice of considering 100 percent instantaneous conversion of lighting load to cooling load. Similarly, conservative design of heating systems usually ignores the heat supplied by the lighting system.

Because the energy input to a lighting system is not always constant during the day, and because it usually is zero during a part of a 24-hr period, it constitutes a periodically varying heat input to an air-conditioned space. Under such conditions, part of the radiant output of luminaires warms the structure at varying rates during the *on* periods, while the rest is convected from the room surface to the room air. It is this portion, plus the convected heat from the luminaire itself, that becomes an instantaneous load on the air-cooling system. During the *off* periods, heat stored in the structure returns to the space as convected heat.

In general, therefore, the instantaneous load is less than the instantaneous input during the *lights on* part of the cycle, but there will usually be a load on the cooling system during the *lights off* part of the 24-hr cycle. Whether or not the total amount of heat that must be removed by refrigeration during a 24-hr period equals the total electrical energy input to the system, depends upon how much outside air can be used for cooling at certain periods of the day, and upon the amount of energy lost by transmission of high temperature radiant energy through glass areas or by conduction through the outer walls of the building.

In certain lighting arrangements, a portion of the system may be so located that some heat can be carried away by a separate ventilating system which uses outside air. In some cases, light troffers can be liquid cooled so that energy absorbed by or conducted into the troffer can be carried away by the coolant. Liquid-cooled ceiling panels perform in a similar way. Although these 2 methods reduce the load on the air-cooling part of the system, they do not reduce the total load on the refrigeration system, if the coolant is cooled by mechanical refrigeration. Obviously, the radiant component so removed will not at any time be stored in the structure. The luminous ceiling method of lighting in which the space is used as a plenum for conditioned air or a passageway for cool-air ducts, presents a still different problem for the air-conditioning engineer.

Because the problems of accurately relating lighting load to cooling load are so varied, and because the energy from lighting systems constitutes in many cases a large part of the total cooling load, the entire problem is a part of the long-range research program of the ASHAE. Certain sections of the problem are being attacked in current research. Some insight into the problem and some useful data have been developed in past research by several individuals, whose findings appear in the technical literature. However, much more data are needed. A well planned research program can bring results. Active participation of the *IES* in the ASHAE program is invited.

Question: In considering the components of the total energy released by lighting units, reference is frequently made to low-temperature *and* high-temperature *radiation. What is the difference between these two types of radiation?*

Answer: In many problems faced by air-conditioning engineers, especially in connection with lighting and solar radiation, radiant energy sources can be conveniently classed as producing high- or low-temperature radiation. The dividing line between these two radiations is the wavelength, between 4 and 5 μ (microns) at which glass becomes completely opaque to radiation. Glass is completely opaque to all radiation of longer wavelengths. For radiation of wavelengths shorter than 4 to 5 μ, glass is transparent to a degree depending upon its composition. Substantially all radiant energy from the sun either in the direct

beam or in the scattered solar radiation, and all of the radiant energy from filament lamps which passes through the glass enclosure of the lamp, is of wavelength shorter than 4 to 5 μ. Most of it is shorter than 3 μ. This radiant energy is termed high-temperature radiation because of the high temperature of the source. An exception to this high source temperature is the radiant energy from a fluorescent tube. Here this source temperature is low, but the energy is short wave, most of it shorter than one micron.

By contrast the temperature of most other sources in air-conditioned spaces rarely exceeds 500 F, approximately the highest temperature reached by the bulb of a filament lamp. Glass is almost completely opaque to all radiation from sources of such a temperature or lower. Hence, such sources can be classed as low-temperature radiators. It is noteworthy that most painted and non-metallic surfaces have low reflectivities for low-temperature radiation, but their reflectances may be very high for high-temperature radiation. Computational work is often facilitated by this arbitrary classification of radiation energy components.

Question: The equipment for cooling systems is sometimes rated in horsepower, other times in tonnage. In the latter case, what basis should the electrical engineer use to size the motors and services?

Answer: Unfortunately, the use of both *tons* and *horsepower* in referring to the rating of air conditioning equipment has fallen into common usage. For air conditioning comfort cooling the refrigeration machine will require approximately one horsepower for every ton of refrigeration developed. For small installations where self-contained units of five horsepower or less are used the total horsepower for the job will run approximately one horsepower per ton, i.e., on five horsepower units the compressor motor will be five horsepower and the fan motor from 1/3 to 1/2 horsepower. As the size of the installation increases and systems other than the self-contained unitary type are used, the horsepower requirements of the refrigeration machine will vary with evaporator temperature and condensing temperature. The horsepower per ton of a refrigerating machine will increase with a drop in evaporator temperature and an increase in condensing temperature. The following table is an example of this variation.

Table 5 — Variation of Horsepower per Ton of Refrigeration Capacity with Evaporator Temperature.

	Condenser	
	Air Cooled	Water Cooled
Evaporator Temp	50 F	50 F
Air Temp	70 F	—
Condenser Water Temp	—	70 F
Horsepower per ton	0.97	0.64
Raise air temperature to 100 F for the air cooled machine and the condenser water to 90 F for the water cooled machine.		
Evaporator Temp	50 F	50 F
Horsepower per ton	1.40	1.01
Drop the evaporator temperature to 30 F and use 100 F air and 90 F water.		
Evaporator Temp	30 F	30 F
Horsepower per ton	1.60	1.46

Table 6 — Example of Cooling Load Distribution in an Office Building

Heat Source	Exterior Offices[a]				Interior Offices
	North	East	South	West	
Glass	27%	56%	51%	56%	—
Lights	61	37	41	36	84%
Occupants	12	7	8	8	16%
	100%	100%	100%	100%	100%

[a]Percent at time of maximum load in each office.

Table 7 — Relative Magnitude of Heat Sources for Various Types of Buildings

	Office Building	Loan Office	Chain Store	Clinic
	A	B	C	D
Glass	11.8%	[a]27.0%	5.7%	14.8%
Lights	42.3	12.9	23.3	[b]16.9
Roof & Walls	9.7	16.8	12.0	33.4
Occupants	13.4	12.2	35.4	15.5
Ventilation	26.6	31.1	21.4	19.4
System Power	3.2	—	4.2	—
	100.0%	100.0%	100.0%	100.0%
Glass + Lights	54.1%	39.9%	29.0%	31.7%

[a]Large expanse of window exposed west.
[b]Assumes 50 percent of lights in use.

The electrical engineer should consult with the mechanical engineer before sizing motor starters, wiring and incoming services for air conditioning installation.

However, the auxiliaries, such as the fans, chilled water pumps, cooling tower pumps, cooling tower fans and miscellaneous motors, may range anywhere from 0.25 horsepower per ton to 1.0 horsepower per ton in addition to the refrigeration. This, of course, depends upon the type of system used, location of equipment, etc. Unfortunately, there is no general rule that can be established within reasonable limits to set up the total horsepower requirements for a given job until after the job has been fairly well designed. The popular concept of *one horsepower per ton* for air conditioning should be discouraged as it is completely false.

Question: When the Illuminating Engineer specifies fenestration and luminaires for a room, does he influence to any extent the cost of installing and operating air conditioning for that room?

Answer: Room lighting, whether solar or from interior fixtures, is an important part of the air conditioning cooling load in many cases. This will be correspondingly reflected in the capacity, first cost and operating cost of the refrigeration equipment and the room cooling system.

The relative magnitude of the lighting load to other heat sources varies widely between buildings, and between various parts of a given building. In this respect, it may be of interest to point out the more common heat load components and to cite a few actual cases showing their relative influence on the air conditioning design.

Usual sources of heat which must be removed from a comfort-cooled room are:

1. Heat transmitted through window glass.
2. Heat transmitted through other enclosing materials.
3. Heat from electric lighting elements.
4. Heat from occupants.
5. Heat from outdoor air inflow due to exterior doors, etc.

All of these five sources of heat are called *interior load* and affect the required capacity of the system used

to cool the room, *i.e.*, ducts and fans or pipes and pumps.

In addition to these, a sixth important source of refrigeration load is the heat which must be removed from outside air before it is used for ventilation.

In Table 6 is an example of interior load distribution in a particular modern office building. In this instance the amount of exterior masonry is so small its heat gain is neglected. Provision was made for fluorescent lighting at 5 w per sq ft (approx 75 to 85 ft-c). It was assumed that the occupants would follow their usual habit of lowering the venetian blinds on the sunny side of the building and turning on the lights.

For the office building of Table 6, the relative magnitude of all heat sources at the time of total building peak cooling load were found to be as shown in Column A of Table 7.

For purpose of comparison, analyses of total cooling load for other recent installations are shown in Columns B, C, and D of Table 7. Heat from lighting in Columns B and C was calculated at 3 w (approx 40-50 ft-c) per sq ft of floor, and Column D at 2.5 watts (approx 35-40 ft-c).

Question: In what way may the location and design of the artificial lighting units affect the distribution of air?

Answer: The arrangement of lighting fixtures which project below the ceiling can seriously disturb the flow of incoming air from diffusers. Where fixtures deflect this primary air stream, downdrafts usually result and are troublesome. Such situations can be avoided only by close cooperation between the architect and the lighting and air conditioning designers on the particular project.

Question: In practice, should the illuminating and air conditioning engineer consider that both the total heat output of the luminaires and the total heat load of the fenestration be included in the design cooling load of an air conditioned building?

Answer: Though it is common engineering practice at present to include both the *total* cooling load related to electric lighting and the *peak* cooling load related to the fenestration or daylighting system in the *design* cooling load for an air conditioned building, it is likely that only part of these loads are actually imposed on the cooling system simultaneously in common operating practice.

It is safe to assume that in spaces within 30 ft of an outside wall, a sizeable heat gain contributed by solar radiation through sidewall fenestration will be associated with sufficient daylight illumination that operation of the electric lighting system will not be necessary. Similarly, where an adequate electric lighting system is operated continuously, fenestration shading devices usually are adjusted for most effective reduction of solar heat gain and glare during periods of peak solar load (August 1, West elevation).

Zonal integration of air conditioning distribution, automatic photoelectric-cell control of electric lighting and of fenestration shading warrants special study as it may contribute materially to the achievement of a satisfactory total environment at minimum initial and long-term operating cost to the building owner.

Question: What is meant by Instantaneous Heat Gain, Air Cooling Load, Design Cooling Load and Equipment or Refrigeration Load?

Journal Section

Answer: These terms are commonly used in the profession and literature, but have not been standardized in their meaning by Society definition. In general, however, the following are the accepted meanings:

Instantaneous Heat Gain: The rate at which heat enters or is created in the space at a specified critical time — usually the time of maximum heat gain as established by experience or calculation. The usual sources are people, equipment, luminaires, sunshine through fenestration, conduction through all room surfaces, and infiltration of outdoor air around windows and doors.

Air Cooling Load: The instantaneous rate at which heat is to be removed by passing cooled air through the space. This differs from the *Instantaneous Heat Gain* due to one or more of the following: (1) Acceptance of a small rise in temperature of the space air during the warmest part of the hottest days each season. (2) Storage of radiated heat in the building internal structure and furnishing each day with complete release before the next morning. (3) Removal of part of the heat by other means (such as local water-cooled or air-cooled *radiant* cooling panels or luminaires, or local water cooled air cooling coils).

Design Cooling Load: Is the maximum rate at which the designer estimates heat will have to be removed from the space. In the past this has usually been the same as the *Instantaneous Heat Gain* since so little has been known about evaluating structural storage of heat and it has been the general practice to hold the space air temperature constant. It has also usually been the same as the "Air Cooling Load" since it has not been common practice to install localized equipment to accumulate heat in water for removal by that medium.

Equipment or Refrigeration Load: The maximum rate at which heat is to be removed by the equipment. This differs from the *Design Cooling Load* in that it also includes the heat removed in cooling and dehumidifying the air taken in through the air conditioning equipment for building ventilation.

Make Reservations Now for 63rd Annual Meeting
Chicago, Ill. — February 25-28, 1957

Abstracts . . . . from a Symposium on

Residential Air Conditioning

W. A. Grant, Moderator

Vice President, Carrier Corp., Syracuse, N. Y.

One of the seven sessions at the Semi-Annual Meeting of ASHAE in Washington, D.C. (on June 20, 1956) was devoted to a symposium on *Year-Round Residential Air Conditioning*. Five selected speakers presented their views on assigned topics. A discussion period followed.

What is included here is a greatly shortened version of the prepared papers of the speakers. Considerable sections of the text and nearly all illustrations are omitted entirely. Other parts are paraphrased and edited. The papers, substantially in full, with illustrations and with a digest of the floor discussions are to be made available as a separate Bulletin. See page 139 of this issue.

I — Maintaining Comfort Through Control of the Compressor*

W. H. SCOTT—Residential Air Conditioning, Minneapolis-Honeywell Regulator Co., Cleveland, Ohio. B.S. in mechanical engineering, Kansas State College. In 1954 Project Manager for the *National Warm Air Heating and Air Conditioning* at the Austin Village Project of the *National Home Builders Association*.

Being concerned with the control of air-conditioning equipment as applied to residences, our company has been involved in field test work as well as research to determine the best method of control to obtain maximum comfort. The present discussion includes some of the results and conclusions obtained as well as mention of a theory of operation prepared by Dr. Preston McNall's research group.

Field investigation indicated how vitally important the control of dry-bulb temperature is in the maintenance of comfort. The ASHAE Comfort Chart shows that the dry-bulb temperature directly affects the effective temperature and therefore close temperature control will hold variation in effective temperature to a minimum.

There are indications also that if the dry-bulb temperature is maintained at 76 F or lower, relative humidity variations within the space do not affect comfort as greatly as with a higher dry-bulb temperature.

It has also been found that home owners who have put in air conditioning may start with the thermostat set at 80 F, but they progressively lower the set point to around 74 to 76 F.

Another home-owner preference is the desire to maintain constant fan operation during the cooling season. This was pointed out by the Austin Village tests and has been confirmed by additional investigation.

To control at a set point, say 76 F, one must be able to vary the output of the equipment as the load changes. As residential equipment is installed today, control is obtained by varying the output through turning the compressor *on* and *off*. Heating experience has shown that to obtain acceptable dry-bulb temperature control a reasonably fast cycling period must be utilized. When a low thermal capacity system, such as the present air conditioning, is used, this period should be approximately 3 or 4 full cycles per hour. (Throughout this discussion a cycle means the time required for a complete *on* and the subsequent complete *off* of the equipment).

With constant fan operation desirable for comfort, the next question is, what happens to the humidity when control is from dry-bulb level with compressor cycling.

One school of thought holds that cycling the compressor with constant fan operation increases humidity. This suggests that long compressor operations be maintained thus providing maximum dehumidification and minimum re-evaporation from the coil. This thinking is in conflict with the good dry-bulb control needed for comfort.

Now consider some of the accumulated data. In one contemporary home with presently accepted cycling rate and under 40 percent load conditions, the unit was off about 27 min and on about 18 min (somewhat faster cycling than average). The dry-bulb temperature swing was 4.3 deg, the relative humidity swing 9.2 percent and the effective temperature swing was 3.6 deg. This is an extreme case caused by a particular combination of unit, duct and house construction. Heating experience indicates that this kind of temperature swing was common about 15 years ago, but that now most people find such swings in the heating season completely intolerable. It appears that after people become more critical, having had cooling for a few seasons, they demand better control of temperature swings. As previously noted, they have already moved the temperature control down to 76 F, affording a more comfortable living space.

An average of data from several installations on which acceptable controls were used showed dry-bulb temperature swings of 2.7 deg and relative humidity swings of 5 per cent again unsatisfactory by standards maintained in heating.

It must be recognized that relative humidity swings such as those just described are affected by coil position which is a factor in the amount of moisture re-evaporated with constant fan operation.

Close temperature control can be effectively maintained by using anticipation within the thermostat on the cooling side in the same way that it is now used in the heating. Test results of such an experimental thermostat from a typical installation, and maintaining 6 cycles per hour (10-min period with 5 min *on* and 5 min *off*) and operating under 50 percent load conditions showed only ½ deg dry-bulb swing and 1½ percent relative humidity swing. Such swings would be most desirable from a comfort standpoint.

Assuming then that it is desired to hold the dry-bulb temperature variation to a minimum of around ½ to 1 deg, what

*Prepared by W. H. Scott in collaboration with Dr. Preston McNall, Jr., chief of Applied Research, and J. E. Janssen, research engineer, Minneapolis-Honeywell Regulator Co.

effect will this have on the relative humidity level?

Many records from residences show that relative humidity increases as part load operation proceeds. These records usually show late evening conditions where the unit has been on 100 per cent of the time—then as the unit starts cycling, the relative humidity begins to climb. Upon analyzing these data, it was found that relative humidity increased due to the depression of the dry-bulb temperature and that the specific humidity or the moisture that the coil actually sees did not increase nearly as much as was supposed from the initial observation of the relative humidity record.

Many statistical studies of results during our programs with thermostats and other controls were carried out. The results cover a wide range of cycling periods from 12 typical houses with 6 or 8 determinations for each house involving different thermostats, different loads, and different units. It was found that the rate of humidity drift was upward when going from full load operation into part load operation. From further study of this information it seems true that the humidity level always increases at part load conditions, but this is felt to be due to the fact that at less than full load the latent part of the load is a greater percentage of the total load than at full load. The nature of our present systems is such that the sensible-to-latent ratio of the coils cannot reduce at part load, but at best could remain constant for any load.

From the test data collected it can be concluded that the increase in humidity that occurs at part load conditions is minimized at the shorter cycling periods.

This result, if correct, indicates that better control could be obtained by cycling units considerably faster than the presently accepted rate. Dr. McNall and Mr. Janssen developed a theory to logically explain this result. They plotted the moisture removal rate and infiltration and production rate as time proceeds from the start of an *on-cycle* after a long *off-period* where no cooling was required. It appears from a study of this plot that the unit can be on for any length of time and off for any length of time, and by analyzing the area above and below the line of zero moisture flow rate one can see where the humidity will be at the end of the first complete *on* plus *off* cycle. As the cycles are shortened the end humidity becomes higher than at the start. This indicates that the final average humidity after an extended period of cycling is higher than for extremely long cycles. Furthermore as the cycles are shortened, the end humidity reaches a peak and then drops rapidly until the end humidity is considerably lower than at the start. Short cycles seem to take advantage of the maximum condensing rate early in the *on-cycle* and then another *on-cycle* starts before the coil has had a chance to dry completely. The most undesirable cycling rate would occur when the unit was turned on again just as the coil became completely dry, and from experience with coils complete drying requires about 20 to 30 min. This is right in the range of the presently accepted cycling rates. In other words, it appears that a poor condition has been allowed to exist which could be improved by more rapid cycling.

Summary

1. Part load operation must be considered because any system will spend most of its time operating at less than full load if it is controlled automatically.

2. Unit design and sizing in the future should allow control of dry-bulb temperatures of 76 F or below to maintain comfort.

3. The usual unit should at present be controlled by cooling anticipation thermostats designed to cycle the units considerably faster than at present.

Experience shows that to keep the dry-bulb swings to acceptable levels of about 1 deg, in the average installation, 3 cycles per hour at 50 percent load should be the immediate future goal. This is approximately 10-min *on* and 10-min *off*. This cycling pattern should give better control from all standpoints than the heretofore accepted control methods.

Journal Section

II — Fuel-Electric All-Year Systems

W. E. HOOD—Development Department Manager, Unitary Equipment Division, Carrier Corp., Syracuse, N.Y. Joined Carrier in 1941, previously employed by the Modine Manufacturing Co. Graduate, University of Wisconsin. His memberships include the *American Gas Association, ASRE* and the *National Warm Air Heating and Air Conditioning Association.*

Fuel-electric all-year residential air conditioning has suddenly blossomed into one of the most rapidly-growing products on the American scene. In 6 short years the number of homes equipped with this type of year-round air conditioning has jumped from 1,000 to 200,000—an increase of 2,680 percent.

Fuel-electric air conditioning is defined as a combination of a heating system burning one of the conventional automatic fuels, such as gas or oil, plus the equally conventional reciprocating compressor type of electric-driven refrigeration cycle.

First let us give attention to the phenomenal record hung up by the infant residential air-conditioning industry. [At this point Mr. Hood presented illustrations showing (*a*) the year by year increase in total number of central residential air-conditioning systems installed from 1950 to 1955; (*b*) the estimated figure of 200,000 systems for 1956; (*c*) the projected number of 540,000 installations for the year 1960. He also indicated that the current estimates place the 1956 total for all electric systems at 3 percent of the total, and that by 1960 this might reach 3.6 percent of the projected total. All-fuel types of systems (at 1 percent) are believed to be fewer than the all-electric but no accurate estimate is possible now. He also showed figures covering the number of warm-air furnace installations made, each year from 1950 through 1955, and stated that even with the 540,000 installations predicted for 1960, the potential market would only be scratched. These illustrations are omitted here for lack of space but it is expected that they will be included in the proposed Bulletin to be issued soon—EDITOR.]

So much for the record established so far and the market challenge which is faced. Now, let us look at the challenge in terms of equipment design.

If the fuel-electric system is to meet its market challenge and continue to receive acceptance by the American public, following is a brief outline of some of the design problems which must be faced and solved.

In line with the architectural trend toward more efficient use of floor space, this equipment must be smaller and more compact. This calls for the development of smaller, more efficient combustion processes for heating; smaller high-speed compressors; more efficient transfer surface; and high velocity, high efficiency filters. These are only a few of the improvements leading toward smaller units. In addition, there is the possibility of entirely new concepts in refrigeration cycles.

Future customers have the right to expect reduced equipment costs as a result of increasing production and refinement of design. In addition, costs will be reduced through decrease in the number of sizes and types of units offered. A recent advertisement by one large manufacturer boasted of 112 separate models. This is almost as bad as the three-colored combinations offered in automobiles and surely is not the way to keep production quantities up and costs down.

Recent market surveys indicate that the biggest single complaint is that the equipment is noisy. Fans, compressors and combustion processes must be designed for quieter operation.

Installation costs must be reduced. This is one of the most fertile fields of improvement available. Almost half the cost of a residential system is covered by the work and materials required at the site. Prefabricated ductwork, simplified controls and simplified installation wiring will help to reduce this cost. More com-

pletely packaged equipment, improved air distribution systems, and a standardized approach to installations will also help.

Proper presentation of the sales story will help to meet this market challenge. Customers and prospects are presently confused by the claims and counter-claims made with reference to horsepower, tons and Btu. None of these terms is understood by the average person and, when used in the flexible manner currently popular, they are not likely to be readily understood by the customer. A language is sadly needed along with a means of identifying sizes and capacities which customers can understand.

Now let us consider the various types of fuel-electric systems being offered. Variations in home construction across the country require many different types. Likewise, changes in home design over the last 50 years also dictate that equipment designed for use in existing homes must be sufficiently flexible to adapt itself to the many types of construction used during the years.

One system makes use of the single-package combination heating and cooling unit. This package includes all of the functions for year-round air conditioning. The equipment is generally available with either air-cooled or water-cooled condensers.

A second system makes use of the multi-package combination built up around a series of elements, each of which performs one or more of the functions required for year-round air conditioning. With this type of system, the heating can be installed and operated separately and the cooling can be added at a later date. Likewise, the cooling functions in this set-up can be added to most existing forced warm-air heating systems. Here too the condenser can be either air-cooled or water-cooled.

In both of the previously mentioned systems the presence of a duct system for the distribution of the conditioned air is assumed. Existing homes originally with wet heat can have cooling added by any one of a variety of methods one of which is by using a fan-coil combination inside unit with its own ductwork plus an outdoor air-cooled condensing unit.

Frequent reference has been made to air-cooled and water-cooled condensers. The air-cooled condenser using the outdoor air as the heat sink has become increasingly popular in recent years, and a trend toward this type of condensing has definitely been established.

[Mr. Hood illustrated the several existing systems mentioned. His illustrations are omitted here but it is planned to include them in the projected Bulletin—Editor.]

As pointed out earlier fuel-electric systems have dominated the market and are forecasted to continue to do so within the predictable future. Whenever one type of product maintains 95 to 97 percent of the market, the principal reason is generally product cost. This is true of the fuel-electric residential system. It enjoys not just 1 but 4 cost advantages. The original equipment is less expensive than similar all fuel and all electric systems; its installation is less expensive, resulting from the greater flexibility and general adaptability of the many models available. Operating costs for the fuel-electric system are lower, making the best possible use of the cheapest energy available for heating and cooling purposes. And equally important is the fact that lower maintenance and service costs prevail with this type of system. This is true because of the use of simplified components whose design has been refined and proven through many years of use in heating and cooling.

From the customer preference standpoint, the great flexibility of fuel-electric systems has considerable appeal. The user has a wide range of equipment manufacturers to choose from and, therefore, can get as many quotations as he wishes. The customer also likes the flexibility in choice of fuel, permitting him to use gas or oil, depending upon the local situation. Extreme flexibility in capacities for heating and cooling are available and these can be teamed up to meet the widely-separated requirements represented by the various climates in this country. Flexibility of installation, using multi-piece equipment of the add-on type, gives the customer the choice of installing heating now and cooling later.

III — Fuel Operated All-Year Systems

All of us are now aware that fuel operated air-conditioning equipment will assume an increasingly large place in the air-conditioning market. Coupled with the ability of fuels to burn for direct production of heat during the heating cycle we thus have complete fuel operated all-year systems. Most of the work now being done in this area contemplates gas as the fuel material.

For a long time gas utilities have desired to build summer load and to increase consumer sales. Increasing use of liquid petroleum (LP) gas for heating purposes has created similar problems within the LP field and hence LP producers and distributors would like to find summer load building means.

Recognizing this situation several manufacturers initiated efforts to develop reliable gas air-conditioning equipment for general application. This led into research and broad field tests in types of air-conditioning cycles not yet in even meager production. In addition one equipment manufacturing company which was already in production on gas-fired all-year systems using absorption principles for cooling announced improved equipment physically smaller and more efficient than similar older equipment, which can be changed from heating to cooling with greater facility.

Many basic cycles can employ gas or other fuels as an energy source for air conditioning. Much intensive work has been done using the jet pump principle to provide refrigeration, to employ the adsorption system for deep dehumidification followed by a rehumidification step to reduce dry-bulb temperature in open absorption systems, and even in the possible use of gas turbines and compressors. However, most of them are still some distance from practical mass production.

My own company has obtained encouraging results in some of the foregoing cycles but the most encouraging results for future cycles are coming from work on the external combustion engine, sometimes referred to as a hot-air engine. Prototypes of such systems will soon be in operation. We are greatly interested in the elimination of carburetion devices, starting devices, ignition systems and the entire problem of burning fuel within a cylinder. Numerous reports of progress in this area will be seen in trade and general interest publications before long.

A. B. NEWTON—Vice President Design and Research, The Coleman Co., Inc., Wichita, Kan. B.S., Syracuse University; M.S., Massachusetts Institute Technology. Author many papers and articles. Currently president Kansas Chapter, ASHAE. Served on numerous ASHAE Committees. Author widely used psychrometric chart. Member *ASME, ASRE, ASHAE*. Registered Professional Engineer, Ohio, Kansas. Listed *Who's Who in Engineering*.

Equipment Currently Available

Today two general types of equipment are in production for gas powered air conditioning and heating. In the first type the same equipment provides both heating and cooling functions with the same fuel burners. In the second type air conditioning is produced by some remote piece of equipment and the actual cooling effect within the residence is obtained by separate air handling units or by coils placed in duct systems associated with warm air furnaces. In some cases too the remote equipment is used in conjunction with wet heat systems by providing chilled fluid to air-handling equipment that is either the same as or supplementary to that used for heating.

Heating and Cooling with a Common Fuel Burner: The first approach is well

exemplified by the absorption units previously mentioned, which employ a gas flame to concentrate a solution which is then transferred to an absorber within the unit. Here the solution is exposed to vapors from a fluid in the cooling coils which are quickly absorbed and thus the fluid cools the coils like any other refrigerant. The solution is thus weakened and passes back to the heated portion of the system where it is again concentrated. These systems have the advantage of several years of actual use in the field. Heat is carried out of the house by a water circuit similar to the condenser water circuit of a water-cooled electric air conditioner. However, considerably more heat must be disposed of and this must be taken into consideration when cooling towers or other water saving devices are employed. The system has nearly ideal simplicity in changing over from heating to cooling and vice versa. For cooling the fuel input and the cooling water circuit function together, the presence of the cooling water carries away heat and causes the cycle to perform a cooling function. For heating the fuel supply functions alone no cooling water being supplied, and since no heat is being carried away by cooling water it is carried away by the air circuit to the house thus heating the house.

Burning Fuel Separately for Heating and Cooling: Early in our studies of gas fueled remote systems it was evident that an internal combustion motor gave the greatest promise of an immediate and satisfactory unit for production. Our company therefore initiated a program to develop and prepare for production residential air-conditioning equipment of this type. The program was started just about 3 years ago. Some of the results are presented here. Incidentally at least 3 other manufacturers are now interested in gas motor-driven air-conditioning equipment and have some small production.

This year several hundred units (see Fig. 1) have been produced and most of them are in operation. The equipment consists of a completely self-contained gas motor-driven refrigeration system complete with an extremely efficient evaporative condenser and including a compact efficient liquid chiller. The gas motor drives a circulating pump for the chilled liquid so that the equipment is a complete factory assembled refrigeration system and has the usual flexibility of a chilled liquid unit. Starting is accomplished by a direct connected crankshaft mounted starter and no gears or clutches need be engaged or disengaged in starting which requires less than 10 amps at 115 volts from a standard convenience outlet. The gas motor is cooled by air from the evaporative condenser which is usually 10 to 20 deg cooler than the ambient air. Furthermore, this moist cool air is used in the mixture to supply the engine resulting in almost ideal engine operating conditions. The gas motor itself drives the fan for the evaporative condenser as well as the circulating pump for the chilled liquid circuit.

Table 1 — Operating Experience and Costs at 6000 hrs.

Operating Experience, Totals		Costs Unit	Total
1 Hours operation	6000		
2 Gas used, Mcf	454	50¢	227.00
3 Lube oil used, gal.	18	75¢	13.50
4 Water used, M gal.	66	45¢	29.70
5 Electricity used*, kwh.	1200	0.023¢	27.60
6 No. starts and stops	3960		
7 Total operating cost, 6000 hr, dollars			297.80
8 Cost per 1000 operating hr, dollars			49.63
9 Dollars/ton-hr of rated capacity			0.0165

*For water pump, does not include electricity for blower operation of the air handling unit, as this would be the same on either gas motor or electric motor driven refrigerant compressors.

Much attention was given to obtaining minimum service. Early objectives included 10,000 hr of engine operation free from major service requirements; and operation for at least one season of 2,000 hr (the worst in the country) without addition of oil or attention to minor service items such as spark plugs, breaker points or other ignition adjustments.

That these objectives have been reached is evidenced in a report made recently at a meeting in Chicago concerning a 3-ton system which has now attained more than 6,000 hr of operation in Oklahoma. At 6,000 hr the information in Table 1 was taken.

Maintenance Experience: 1. Replaced 2 electric motors on the water pump of the evaporative condenser during first 300 hr of operation due to a faulty front bearing. The design of bearing was changed to eliminate the trouble.

2. Replaced 3 sets of ignition points and coils, which indicates a season of operation without ignition trouble.

3. Replaced 1 set of spark plugs. New plugs still in machine with 4800 hr of experience. This indicates new plugs needed no oftener than every two or three seasons.

4. Condenser coils in the evaporative condenser are showing some scale, but without noticeable reduction in capacity.

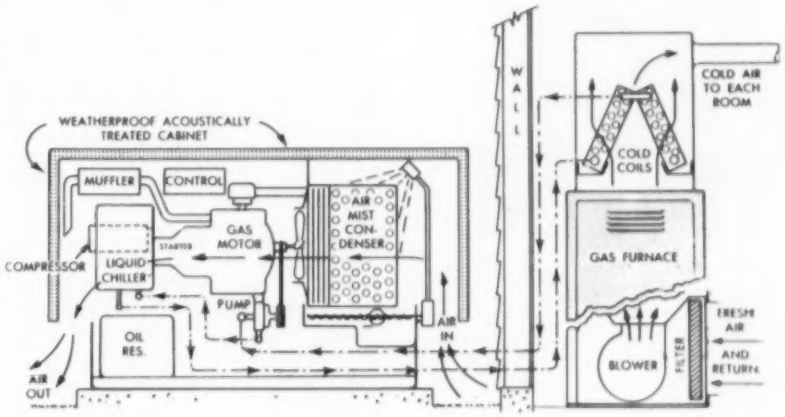


Fig. 1 — Gas motor-driven air conditioner

5. Engine compression pressures and intake manifold pressure still good as when the unit was new.

6. Engine lubricating oil changed after 2000 hr of operation, and oil still tested satisfactory as to viscosity and acidity. Oil consumption has been 3 gal per 1000 hr of operation. This furnishes proof that it will be necessary to change oil only at the beginning of each season.

7. Gas consumption by the engine has averaged 76 cu ft per hr.

8. Valve clearance adjustments needed at 4990 hr indicating check of clearances should be made every 2 or 3 years.

9. Hope to continue field tests to at least 10,000 hrs of operation, representing approximately 8 air-conditioning seasons in Oklahoma.

This illustrates both the type of field testing accomplished and the real dependability of this equipment. Six thousand hours of operation of an automobile at normal driving speeds would account for about 300,000 mi. Who could think of driving a car that distance with only 3 sets of ignition points, 2 sets of spark plugs and using a quart of oil every 17,000 mi and at the end of that time having the engine compression pressures and intake manifold pressure as good as when the car was new? That is what is being accomplished with these gas motor-driven air-conditioning units.

[illegible] year will see vastly increased production and we hope additional dependable entries in this new field. All can be used with the simple time proven gas-fired warm-air furnaces and boilers for heating. Together they provide an extremely flexible and easily applied all-year fuel operated air-conditioning system.

IV — Electric All-Year Systems

E. R. AMBROSE—Engineering Staff, American Gas and Electric Service Corp., New York, N.Y. Engaged in design and supervision of heating, ventilating, and air-conditioning installations for all properties of that firm. Received B.S. degree in mechanical engineering from Carnegie Institute of Technology, Pittsburgh, Pa.

Electric year-round air conditioning can take one of several forms. It can be a heat pump or it can be resistance heating combined with motor-driven cooling equipment, or can be a combination of the two.

Of all the possible electric air-conditioning systems, the heat pump is perhaps the most interesting and fascinating, and probably offers the greatest future potential. Everyone agrees that it is really an amazing device. It is flexible and is easily adaptable to a number of operating cycles. A schematic diagram of one possible operating cycle is shown by Fig. 2. A 4-way valve is used in this particular figure to change the direction of the refrigerant flow between the two surfaces. Two 3-way valves, or a small 3-way pilot valve and a piston actuated director, can be substituted for the 4-way valve. Also capillary tubes can be used in place of the two thermostatic expansion valves. Another possible flow diagram, used quite extensively, employs a fixed refrigerant circuit and water serves as the heat source and sink, with the direction of the water being changed between the two surfaces to supply the heating or cooling to the space. This arrangement is particularly attractive, if suitable well water is available and if an indirect heating and cooling system is desired.

Its adaptability to several operating cycles, as well as a broad selection and flexible arrangement of the component parts, makes the heat pump suitable for a self-contained packaged unit. About 8 companies manufacture 2, 3, 5 hp and larger size packaged heat pumps.

Residential heat pumps are usually thought of as being of 2 hp or larger in size. The ½ to 1-½ hp sizes, commonly referred to as the window or room conditioners also have very attractive possibilities in this field. These smaller units, located in the room, permit maintaining desired temperatures at installation costs not easily duplicated by the larger central plant type of system. These room units have the same operating cycle as previously described for the larger equipment. At the present time, these room conditioners are usually used in areas where the outdoor temperature seldom drops below 32 F. In the colder climates, they are usually used along with resistance heating or else substituted for the larger central plant heating systems in the late summer and early fall. There is no inherent reason, however, why these smaller horsepower units cannot operate throughout the winter, even in the colder areas, and in all probability they will receive wider public attention in the future.

Capacity

Even though the different heat pump designs have similar component parts and equipment arrangement, the heating and cooling capacities may vary considerably, depending on the heat source and heat sink. Just how the capacities vary with the temperature of the medium is illustrated by Fig. 3. The heating and cooling capacity of a heat pump varies directly with changes in compressor suction temperatures and inversely with condensing temperatures. Therefore, for maximum efficiency a reasonably low condensing temperature is necessary along with a relatively high suction temperature. Fig. 3 shows that a constant output, over a wide range of outdoor temperatures, can be expected when using well water as the heat source. A similar constant output, except at a lower value, can be expected when employing a lower temperature medium, such as the earth as the heat source. In the case of air heat source units, however, the capacity drops as the outdoor temperature decreases, which may result in insufficient capacities at the lower outdoor temperatures, unless supplemental heat is used. For instance, as shown by Fig. 3, the 3 hp air unit would balance the heat loss of the structure at about 20 F outdoor temperature and the 5 hp at 8 F. In this case, some form of supplemental heat would be needed if the outdoor design temperature was below these balance points. At the present time, electric resistance heating is usually employed for this purpose.

Considerable thought and study is being given to heat pumps with increased heating capacity at the lower heat source temperatures. In the meantime, electric resistance heating will probably continue to be used to supplement the heat pump

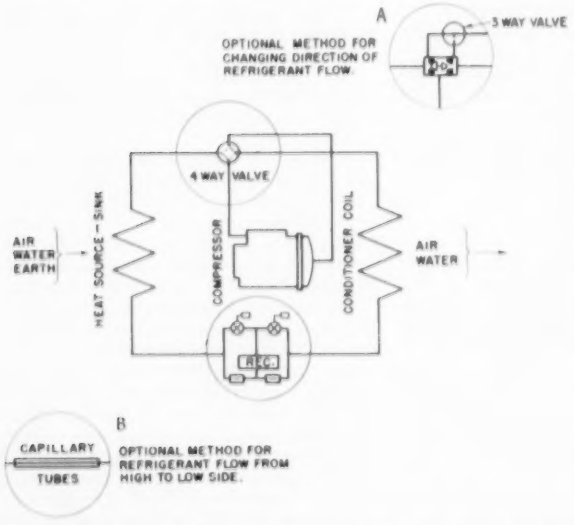


Fig. 2 — Schematic diagram of one possible operating cycle of electric heat pump

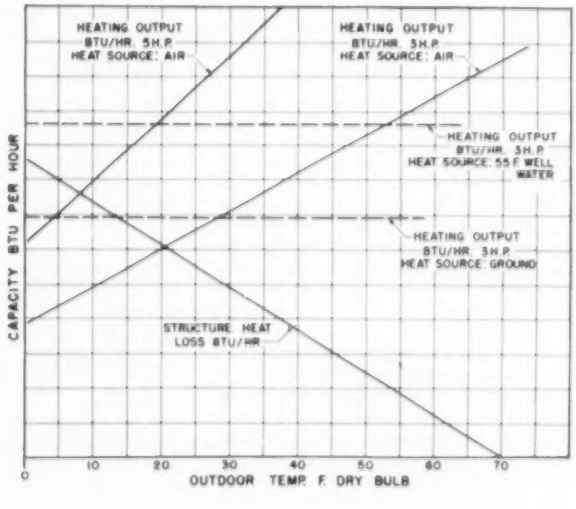


Fig. 3 — Heating output of a 3 and 5 hp heat pump and structure heat loss at various outdoor temperatures

output. In fact, because of its many desirable characteristics, resistance heating is finding increasing favor for supplying all of the heating for the residence. In the modern house with numerous large windows, a heating system must quickly sense all of the external influencing factors. It must be able to maintain a different temperature in the bedrooms from that in the living room, or it must conserve heat by maintaining lower temperatures in the unoccupied space, or prevent overheating in the rooms exposed to the sun while maintaining desired temperatures in the rest of the house. Usually, it is not practicable for central plant systems to be sufficiently flexible to meet these requirements, but it is quite easy with resistance heating.

Electric resistance heating has all the inherent characteristics for furnishing maximum comfort. Since the heaters are located within the space, all losses from distribution systems, usually associated with other types of heating, are eliminated. Another advantage is the ease of obtaining capacity modulation. Capacity modulation is not usually practical with fuel fired heating, but it is accomplished easily with resistance heating by changing the voltage from, say, 240 to 120—this reduces the output to one-fourth of the total which will usually satisfy the heating requirements one-half of the season.

Electric resistance heating can be easily combined with an electric-driven cooling system. The advantages of electric cooling equipment have been adequately covered by a previous speaker. It should be pointed out, however, that the distribution system, consisting of decentralized resistance heating combined with an electric cooling system, is relatively simple when compared with other types of year-round systems.

This possibility of an inexpensive distribution system makes all-electric air conditioning very attractive. A perfect combination in this respect seems to be the heat pump supplemented by a number of resistance heaters located in the different rooms. The heat pump can be sized to furnish the cooling requirements and, in turn, will furnish a portion of the heating during the winter period. If this is not sufficient heating individual resistance heaters will make up the difference. Such an arrangement requires only a simple duct system, if air is used as the heating and cooling medium. This combination also solves the two most common objections of high first cost and high operating cost usually cited against the heat pump and resistance heating, respectively, for many areas of the United States.

This combination of the heat pump, with decentralized resistance heating, is very attractive and deserves the attention of manufacturers, as well as contractors, architects and engineers.

V— Future Developments — Electronic, Solar, Nuclear

This topic in today's symposium has the objective of taking a look into the more distant future. In common for all three of the assigned subjects is that, technologically, they still are at the early stages of research and development. They require basic research. The necessity for extensive research, before the principles of electronic refrigeration and of utilizing solar and nuclear energy can be defined and reduced to practice, should not discourage engineers belonging to this Society. They were pioneers in establishing broad research activities within their profession, and in founding and operating a research laboratory of world-wide reputation.

W. F. FRIEND—Nuclear Engineering Consultant, Ebasco Services Inc., New York, N.Y.; B.M.E., University of Michigan; Member ASHAE Research Committee 1954-1957; TAC on Cooling Load 1942-1953, TAC on Heating Load 1954-1956, TAC on Heat Pump 1949-1956; author numerous technical papers and articles; member *American Nuclear Society, Association for Applied Solar Energy, ASME, AIEE, ASRE, SAE, AIME, AIChE, NDHA.*

Electronic Cooling

By this term is meant refrigeration, or the removal of heat, by means of temperature reduction produced directly by the flow of an electric current, namely, by the movement of electrons within a continuous circuit composed of solid materials. The use of so-called *electronic* devices and complex circuits like those employed in radio and television sets is not involved. The principles in general are called *thermoelectric effects*, a term denoting energy interchange or a conversion between heat and electricity.

Four effects, (table 2) identified by names of the respective discoverers, are present in electronic cooling.

Likewise involved is the principle of conduction, whereby heat is transported or an electric current made to flow between the 2 points, by creating a difference of temperature or electric potential. The several effects are stated in the phrasing conventionally employed, in Table 3; reversibility of the action is indicated by entries in column at the right.

Usually the Peltier effect, which can be considered the converse of the Seebeck effect utilized in the ordinary thermocouple for temperature measurement by the electrical method, is said to be the essential principle of electronic refrigeration. However, each of the other principles is also present in such apparatus and must be taken to account in its design.

Until recently, there were no known materials possessing properties that could satisfy the conflicting requirements well enough to enable building a device with acceptable performance. The materials principally used by early experimenters in electronic cooling were antimony, bismuth, copper, germanium, silicon, tin, zinc. They proved unsatisfactory, since the maximum cooling ranges obtainable varied between 9 and 16 C (15 and 30 F), and efficiencies were extremely low.

Applicable materials are now classified under 3 general types: pure metals, alloys, semiconductors. Characteristics of two of these with respect to the performance criteria are shown in Table 4.

Thermoelectric powers for semiconductors may range up to hundreds of times those for metals. The conductivity ratio (thermal-to-electrical) known as the Wiedermann-Franz ratio, is approximately constant for all pure metals, with value 2.3 x 10^{-8} expressed in appropriate units.

Thus semiconductors offer real promise and are being closely investigated. The common semiconductors are considered to include:

Elements	Ge, Se, Si
Compounds	CdS, CuO, CuS, PbS
Intermetallic compounds	Bi_2Te_3, ZnSb, InAs

With semiconductors both thermoelectric power and electrical conductivity depend upon concentration of the current carriers they contain. These carriers comprise both an electronic component and a lattice or structure component. Thermal conductivity may be nearly independent of the carrier concentration when the major contribution to conduction of heat comes from the elastic vibrations of the lattice, as is the case with germanium, a metal that has become prominent recently through its use in transistors which are supplanting vacuum tubes for many types of electronic applications.

With electronic cooling, it is customary to use the term Coefficient of Performance (COP) for expressing efficiency. This is the ratio of heat quantity absorbed (refrigerating effect) to the power required or the *work* input, measured in the same units. An alternate expression is:

$$\text{COP} = \text{heat flow rate} \div \text{power input}$$

Since for any ideal thermodynamic device the temperatures measured above absolute zero indicate respectively the heat quantities supplied from the source and rejected into the sink, the temperature difference becomes a measure of the work performed. The cycle efficiency may therefore be as:

$$\text{COP} = T_1/(T_1 - T_2),$$

where

T_1 = temperature of the sink.

T_2 = temperature of the source.

Values of COP reported to have been attained have been low — under about 0.3 for a temperature range 20 C (36 F). They decrease markedly when the range needed becomes greater.

Mathematical analysis of the principles underlying the thermoelectric effects listed in Table 3 is built upon the well-known three Laws of Thermodynamics. Such analysis leads directly to the conclusion that there is no theoretical limit on the value of COP that might ultimately be realized. Only practical limitations need be overcome.

The principal concrete achievement so far is perhaps the prototype for a household refrigerator announced late in January 1955, the outcome of development work begun in 1951. The demonstration model is described as having a large number of thermo-junctions arranged in two groups, for the main cooling compartment and the freezing unit respectively, with heat removal by tap water. Work in the laboratories is continuing on the refrigerator and on compact units intended for comfort air conditioning, that will require no external circulating water for heat removal.

In England encouraging results have been reported with junctions using the n-type semiconductor Bi_2Te_3 and metallic Bi which produces 26 C (47 F) maximum temperature difference with coefficient of performance believed as high as 0.25. There are hopes that the electrical-to-thermal conductivity ratio can be further improved by a factor of 4 or 5, and if this is ultimately accomplished, a temperature difference of better than 80 C (144 F) should be realized.

In the United States, thermoelectric effects are known to be under investigation at Battelle, Cornell and other laboratories, and among European countries in England, France, Germany and Sweden. A research program is also in progress which embraces both theoretical and experimental research to determine principally the materials, geometry and fabrication methods for commercial applications of Peltier junctions, and related factors in thermoelectric behavior.

When solutions to the interrelated problems are found, the principles of *electronic cooling* give promise that they can with equal success be applied to the direct conversion of heat into electric power. Moreover, they may also be found applicable to power generation with radiations from the sun and from the radioactivity that can be created by nuclear reactions.

Table 2 — Effects Present in Electronic Cooling

Effect	Device	Cause	Result
Seebeck	Junction of dissimilar metals	Temperature difference	Electric current
Peltier	Same	Electric current	Heat emission or absorption
Thomson	Single conductor	Temp gradient, also current	Same
Joule	Electric circuit	Electric current	Heat emission

Table 3 — Thermoelectric Refrigeration for Air Conditioning Basic Principles and Definitions

Effect	Action Produced	Condition Maintained	Reversibility
1 — Thermoelectric	Energy interchange, or conversion between heat and electricity	Difference of temperature or of electrical potential, between two points or across a junction	See (2) to (5)
2 — Seebeck (1821)	Electric current within a closed circuit composed of two dissimilar conducting metals	Junctions kept at different temperatures	Yes, becoming (3)
3 — Peltier (1854)	Heat absorption or emission produced at junction of two dissimilar conducting metals	Electric current passed through junction by applications of voltage	Yes, becoming (2)
	(Direction of current flow determines whether heat is absorbed or emitted, *i.e.*, whether temperature is lowered or raised)		
4 — Thomson	Heat absorption or emission along a single electrical conductor having a finite temperature gradient	Electric current passed through conductor, while temperature gradient maintained	Yes
	(Flow same as noted for 3 — Peltier effect)		
5 — Joule	Conversion of electrical energy into heat	Electric current passed through conductor	No
6 — Conduction	Transport of heat or flow of current between two points in any substance	Difference of temperature or electrical potential	No

Table 4 — Performance Characteristics of Pure Metal and Semiconductors

Property Requirement	Thermoelectric Power High	Conductivity Ratio Low
Characteristics of materials		
Pure metals	Very low	Constant
	.... Wide Range	
Alloys Semiconductors	Quite high	Much lower than for metals

Solar Energy

The laws that govern the quantity and direction of solar radiation in a given spot on the earth's surface are now well known. Weather Bureau stations, observatories and solar research laboratories are supplying voluminous local data on sunshine availability and its relation to the local needs for heat. The work by R. C. Jordan and J. L. Threlkeld at University of Minnesota, presented recently in a series of ASHAE papers, provides a sound basis for design of utilization systems and equipment. Further useful information is contained elsewhere in ASHAE literature, much of it having originally been secured from the *liability* standpoint, since for summer air conditioning solar radiation is unwanted and forms a substantial component of the cooling load to be handled by air-conditioning systems.

The primary application for solar energy, that is likely to become useful and economic in the not distant future, is in space heating. The chief deterrents are economic, since without an effective method to accomplish thermal storage, a supplementary heating source is necessary for use through periods devoid of sunshine, and this is expensive. Seldom can solar energy be applied economically as a supplementary heat source, merely to reduce fuel bills.

The indirect method of space heating, which involves both a solar collector and a heat-transfer medium, represents the direction of main development effort today. Collectors are of 3 basic types:

1. Focussing reflector, essentially a movable mirror.

2. Flat plate absorber, essentially a shallow insulated box with glass or plastic cover plates.

3. Intermittent system, employing gases that absorb radiant energy.

In the first type, (1), the mirror reflectors must have parabolic shape, either circular or cylindrical, and be moved individually or by motor drive, to follow the sun. Dis-

Table 5 — Representative Values for Vertical South-Facing Collectors Having 2 Sheets of Glass

	Time		Btu per Sq Ft per Hr	Efficiency, Percent Temperature Difference, F		
Weather	a.m.	p.m.		50	100	150
Clear	10	2	300	60	48	31
Few clouds	10	2	200	54	36	12
Overcast	Early am or late pm		100	37	0	..

advantages are high initial cost and maintenance expense, along with vulnerability to storm damage, outweighing the benefits from higher temperature obtained. The second type, (2), is based on the *greenhouse* principle; at bottom of the box or frame it has a dull black plate conductively bonded to a tube through which a heat-transfer fluid is continuously circulated, or an equivalent form of construction if air or a gas is the heat transport medium. Four sheets of cover glass give the best thermal performance, but at present prices two or at most three are the economic maximum. The intermittent principle in (3) remains comparatively undeveloped.

Collector efficiency for the flat-plate type (2) depends on the specific design, materials used including thermal insulation, physical condition, orientation, weather conditions, and upon temperature difference established between the collector plate and outdoors. Some representative values for vertical south-facing collectors having two sheets of glass are shown in Table 5.

The low efficiencies realized with high collector temperatures on cloudy days require that, for house heating, only moderate temperatures be employed.

Thermal storage in many forms has been investigated for dwellings heated by solar radiation and by electricity. The systems tried include:

Massive wall and floor construction, usually of masonry.

Bins filled with rock or gravel, arranged with passageways or pipes for circulating air or water.

Tanks containing heated water or other fluid, with provision for pumped or thermosyphon fluid circulation.

Chemical transition compounds employing the heat-of-fusion principle.

Performance obtained with experimental storage installations has been recorded in many tests and analyzed to determine the best combination of storage type and capacity, and especially to correlate with the collector, since the use of storage usually requires higher operating temperature and thus penalizes collector capacity and efficiency. The chemical methods have shown considerable long-range promise.

Another form of thermal storage, applicable to residential heating and universally available, is use of the ground beneath or adjacent to the dwelling. Thermal properties of soils have been investigated through the past decade, to a limited extent with storage of heat gathered by solar collectors as the objective, and in much greater detail as a potential heat source for electric heat-pump systems.

Another method of gathering solar energy is applied for house heating, in connection with electric heat pumps that use outdoor air as the heat source. By placing the evaporator coil of the refrigeration (heat-pump) system in a location where it receives incident radiation directly, the heat so absorbed raises the input temperature and improves the heat-pump coefficient of performance. Basic principles, test results and economic valuations in this field have been covered in the literature, notably from the work reported by Ambrose, Jordan, Lof, Threlkeld, Voegli, etc.

Further use of solar radiation as an energy source for summer air-conditioning is contemplated in various studies and experimental projects. The absorption cycle, adapted to operate with a modest spread between heat intake and rejection temperatures, is contemplated in the majority of cases.

Solar water heating for domestic uses has a long history in both tropical and temperate zones throughout the world. Design data today are well established.

The present status of solar energy utilization was reported in great detail during November 1955, at the World Symposium on Applied Solar Energy held in Phoenix and Tucson, Ariz., under direction of the *Association for Applied Solar Energy* founded at Phoenix earlier in that year.

Nuclear Energy

Among the investigations being conducted under governmental auspices and by private agencies, into the peaceful uses of atomic energy, none has yet given specific attention to residential air conditioning. The so-called McKinney Panel, which issued its report in January of 1956, had been given the assignment "to appraise the present and future impact of all aspects of the development of atomic energy on our way of life, our economy, our industry and our natural resources . . . ." The report makes mention of district heating service, but stops short of residential applications. Accordingly, the newly formed Nuclear Energy Engineering Committee of the Society, when considering the scope of activities it might usefully undertake, will doubtless have that subject on its agenda.

Principal directions in which future developments in atomic energy might ultimately affect residential air conditioning are:

1. As a supplementary *fuel* or heat energy source, for bulk generation of electric power thereby tending to extend the availability of present conventional domestic fuels.

2. As assurance that electric power will continue to be available, abundantly and at low cost.

3. Under circumstances favorable to the establishment of district heating systems, as a fuel for producing steam or hot water for distribution to consumers.

Journal Section

In each of these cases, the utilization of nuclear fuels would be confined to relatively large installations — of capacity ranging between 100,000 and 1,000,000 lb steam per hour, and under conditions permitting operation at a high annual load factor. Smaller installations and low load factors would be penalized by excessive space requirements for the bulky shielding to confine the dangerous radiations, and for other safety measures.

Thermonuclear fuels, which operate on the fusion principle and include certain forms of hydrogen, lithium and perhaps ultimately other light elements, have greatly augmented our weapons stockpile. The outlook for fusion is uncertain today, owing to the controversy between governmental agencies, and industry as to the propriety of releasing from strict secrecy controls the needed basic information and the right to conduct research into non-military applications of fusion technology.

The methods presently contemplated for utilizing nuclear fuels all involve use of some type of reactor. Many forms of reactors are under investigation for generation of electric power and for propulsion of ships and aircraft. These will likewise be applicable to the production of heat for warming buildings, subject to the economic and practical considerations that affect space heating.

Two other aspects of nuclear technology may be mentioned. Proposals to use radioactive fission products, recoverable from the spent fuels after removal from nuclear reactors, received considerable publicity a year or two ago, as a potential heat source for residential heating. Also, there has been speculation and a little research on the possibilities for direct production of electric power from energy contained in the atom, without passing through a conventional thermal power cycle. The so-called *atomic battery* is an example. Both these subjects are reviewed in the report of the McKinney Panel. The atomic battery might some day be combined with electronic refrigeration for comfort air conditioning. However, the use of radioactive fission products from spent fuels holds little promise for tangible applications to residential air conditioning in the foreseeable future.

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All Paths Lead To Chicago For Society's 63rd Annual Meeting

ATTENDANCE at Society Annual Meetings never can be contemplated too far ahead, particularly the 63rd Annual Meeting and the 13th International Heating and Air-Conditioning Exposition in Chicago from February 25 to March 1, 1957.

Members are urged to avoid disappointment by mailing to the hotel of their choice the official reservation form sent to them from ASHAE Headquarters last month. Registration headquarters will be at the Conrad Hilton and additional accommodations for ASHAE members, guests and exhibitors will be reserved at the following hotels: Bismarck, Congress, Harrison, Morrison, Palmer House, Sheraton-Blackstone, Sherman, La Salle, Knickerbocker, Ambassador, Shoreland, Stock Yards Inn, Drake, Brevoort, Hamilton, and Sheraton.

The International Amphitheatre is to be the site of the 13th International Heating and Air-Conditioning Exposition. The Exposition hours will be as follows: Monday 2:00 p.m. - 10:00 p.m.; Tuesday, Wednesday, Thursday 12:00 noon - 10:00 p.m.; and Friday 12:00 noon - 6:00 p.m.

A program of 14 interesting and informative papers, as well as two symposiums, has been arranged by the Program and Papers Committee, W. A. Grant, chairman, and sessions have been arranged Monday through Thursday, February 25-28, leaving ample time free for attendance at the Exposition and participation in committee meetings.

A symposium on industrial ventilation with an outstanding panel of qualified speakers is being arranged by Prof. C. H. Pesterfield, East Lansing, Mich.; and John Everetts, Jr., Philadelphia, Pa., is making plans for a symposium on dehumidification with an equally fine panel.

P. J. Marschall, general chairman, Illinois Chapter Committee on Arrangements, says that the various committee chairmen have been appointed, committees formed, and plans are already in progress to provide an outstanding program of special events for both members and ladies. Assisting Mr. Marschall as vice chairman is H. G. Gragg, Illinois Chapter president, and the honorary chairmen are Society Past Presidents H. M. Hart, S. R. Lewis and A. C. Willard.

The Committee on Arrangements has been divided into three divisions headed respectively by G. Gill Freyder, Ticket Reservations; J. S. Kearney, Entertainment; Herbert Kreisman, Hospitality. The chairmen of the various committees are M. W. Bishop, Reception; E. P. Heckel, Jr., Finance; Mrs. H. G. Gragg, Ladies; R. W. Roose, Publicity; G. V. Zintel, Banquet; L. O. Paul, Sessions; H. C. Stevens, Transportation; W. J. Abraham, Radio & TV Shows; R. J. Salinger, Registration; J. C. Scott, Inspection Trips; E. R. Teske, Information; H. J. Couch, Facilities.

In addition to the reports of the officers and committees, there will be papers presented on a variety of subjects, several being ASHAE Research Laboratory papers.

There will be a preliminary report on pulsations in oil-fired and gas-fired heating equipment now being conducted at Battelle Memorial Institute under the joint sponsorship of ASHAE, *A.G.A.* and *OHI*.

Another paper is the result of a study of the design of the underground coil when earth is the heat source or sink for a heat pump.

One of the papers included in the program is Part II of a study on the effects of floor coverings on floor panel heating. Part I of this study was presented at the last Annual Meeting.

Members with an interest in cooling towers will want to hear the results of several hundred tests over a period of more than a year on three types of redwood cooling tower packings.

An ASHAE Research Laboratory paper on panel heating, as well as a design manual for floor panel heating, will be discussed. This is the result of activity by the TAC on Panel Heating and Cooling, and the ASHAE Research Laboratory where research has been conducted since November 1951 to develop basic information pertaining to panel heating and cooling applications.

How an analogue computer can be used to solve thermal circuits, and a table of outside design temperatures throughout the United States will be topics covered in two other papers.

Further study on the characteristics of downward jets from a vertical discharge heater has been conducted since the Annual Meeting in Cincinnati and the results will be presented at the Chicago Annual Meeting. Information developed through additional study of air cleaning and the dust spot method for evaluating air cleaners will be featured in another paper scheduled for the 63rd Annual Meeting.

ASHAE
ANNUAL MEETING DATES 1957-1960

63rd at Chicago, Ill., February 25-28, 1957
64th at Pittsburgh, Pa., January 27-29, 1958
65th at Philadelphia, Pa., January 26-29, 1959
66th at Dallas, Tex., February 1-4, 1960

EXPOSITIONS

13th International Heating and Air-Conditioning Exposition, Chicago, Ill., February 25 - March 1, 1957

14th International Heating and Air-Conditioning Exposition, Philadelphia, Pa., January 26-30, 1959

2nd Southwest Heating and Air-Conditioning Exposition, Dallas, Tex., February 1-5, 1960

FALVEY FEATURED

The June 1956 issue of *Consulting Engineer* carried a photo on its cover and devoted its personality department to John D. Falvey, consulting engineer, St. Louis, Mo., Life Member of the Society. The feature article outlined Mr. Falvey's career and listed many of the outstanding projects which his firm has designed during the long period he has been a consulting engineer in St. Louis.

LINSKY HEADS APCA

Benjamin Linsky, associate member of the Society since 1949 has been elected president of *Air Pollution Control Association* for the year 1956-57. Mr. Linsky is

Benjamin Linsky

head of the Smoke Abatement Bureau of the City of Detroit. He is also a special instructor on the Wayne University College of Engineering Faculty, as well as a member of the Industrial Land Use Committee of the Detroit Metropolitan Area Regional Planning Commission.

CONNELL REORGANIZES TO ARCHITECTURAL-ENGINEERING

It has been announced that the architectural-engineering firm of Connell, Pierce, Garland and Friedman has been formed in Miami. This brings together three prominent Florida professional engineers and the retiring Dade County school architect. The firm plans to provide complete coordinated architectural and engineering services.

M. H. Connell, senior member of the new firm, has been a member of the So-

M. H. Connell

ciety for many years. It is also announced that the long-established Miami engineering and designing firm, Maurice H. Connell and Associates, Inc., will continue its present operations.

The firm has designed many commercial and industrial buildings, hospitals, parks, water and sewer systems, turnpikes, and institutional projects.

HEAT EXCHANGER REFERENCE BOOK

This 8½ x 11 in. book of 156 pages presents basic heat transfer and flow friction test data on a total of 88 surface configurations covering (1) tube banks, including both circular and flattened tubes, with both inside and outside flow (2) plate-fin surfaces, with a variety of fin types (3) finned tube surfaces, with both circular and flat tubes and various types of fins, and (4) screen and sphere matrix surfaces. The book is intended for designers and summarizes all of the data contained in 22 reports covering projects initiated by the Office of Naval Research and certain supplementary data from the Naval Engineering Experiment Station at Annapolis. An objective of the authors is a common treatment of all the surfaces considered, thus avoiding the confusion so often encountered with a large number of arbitrarily defined parameters. The resulting simplification for the heat-exchanger designer is quite apparent. A substantial part of these data heretofore has been available only in research reports. They are now brought together in one volume for the engineer who is working in this rapidly expanding field. *Compact Heat Exchangers*, by Professors Kays and London of Stanford University, published by The National Press, Palo Alto, Calif., $5.00.

AIR CONDITIONING AND ENGINEERING HANDBOOK

The second edition of *Air Conditioning and Engineering* is reorganized and altered in format and content from the first edition of this widely used work. The present edition is divided into six sections on: Air Conditioning and Refrigeration; Heating and Ventilating; Industrial Processes; Mechanical Draft; Dust Collection and Control; and Fluid Drive Power Transmission. Included are fundamental principles, laws and tables, determined experimentally or mathematically; sample calculations in considerable detail; and a compilation of data based on the experience of the authors, their predecessors, and contemporary engineers throughout the country. A distinct effort has been made to treat all subjects in a practical manner so that readers of the book will find the data useful in the solution of air engineering and power transmission problems. Book is 6 x 9 in. page size, 260 pages, and published by American Blower Corp., $6.00.

ARI PUBLISHES RESIDENTIAL A-C STANDARD

A revised standard (610-56) on application engineering for Year-Round Residential Air-Conditioning is announced by the *Air-Conditioning and Refrigeration Institute*. The new Standard specifies minimum application engineering standards and includes a one-page form for estimating cooling load on residential installations. This is the first such form to be made available.

A feature is the inclusion of a roof-overhang factor in calculating shaded and unshaded areas of windows, and another is a revision of the table covering design outside conditions.

At the same time, *ARI* has announced that it is making available extra copies of the cooling load estimate form in pads of 50 forms, for use by contractors and others estimating cooling loads in specific residences. The forms may be purchased from *ARI* at $1 per pad of 50. The revised Standard 610 is available at 50 cents per copy.

The Standard was prepared under the direction of the Engineering Committee of the Year-Round Residential Air-Conditioning Section of *ARI*, headed by J. O. Yund, a member of the Society, who is chief applications engineer, Air Conditioning Division of Servel, Inc.

Thermal Circuits

by S. F. Gilman*, Syracuse, N. Y.

What is the maximum cooling load that must be handled by the air-conditioning equipment in a particular building?

An answer is not easy. The principal sources of cooling loads are unsteady, varying with the time of day. The outdoor temperature and the position of the sun in the sky are continually changing. In commercial buildings, many lights are turned on at the beginning of the work day and off at the end. Heat is stored in the structure at one time during the day and released at some other time. Hence, the problem is one of unsteady-state heat flow, which even under simple conditions can become complex and difficult to solve.

Several years ago, in response to demands for means of calculating actual cooling loads, the ASHAE Laboratory investigated the feasibility of representing complex thermal systems by equivalent electrical circuit diagrams. The Laboratory also investigated methods of solving the resultant thermal circuits. Preliminary work, both at the Laboratory and at cooperating institutions, demonstrated the potential value of this approach. Since the thermal circuit technique is also applicable to problems in fluid mechanics and thermodynamics, in 1955 the Committee on Research appointed a TAC on Thermal Circuits.

Scope of Committee

At an organization meeting held in January during the Annual Meeting in Cincinnati, the following scope was adopted: To develop and validate methods of determining the behavior of complex thermal systems, with special reference to periodic or nonsteady heat flows, and to formulate application engineering data in cooperation with other Technical Advisory Committees.

Methods of solving thermal circuits include analytical and numerical techniques, hydraulic and

electric analogues, and differential analyzers. From work done by various investigators, these methods have been examined and qualified. At the recent meeting in Washington, attention was therefore directed to the validation of these methods. Solutions by any particular method can be no more accurate than the values of the material properties, such as convection coefficients, that must be assigned to applicable portions of the thermal circuit. As is usually the case, many compromises must be made to simplify the problem so that a solution can be obtained with a reasonable expenditure of time and money. Review of literature discloses meager experimental data proving that the thermal circuit accurately simulates the performance characteristics of actual structures.

Current Program

As a consequence, a comprehensive and ambitious program was formulated at the recent meeting in Washington and has as its primary objectives: (1) investigation of the influence of the separate factors involved in the thermal circuit, and (2) experimental validation of the procedures being used.

Concurrently, a research project at the University of California at Los Angeles is being partially supported by ASHAE funds. Here an electric analogue has been used to predict the behavior of a test structure that was neither heated nor cooled. Current objectives are: (1) design and fabrication of a thermostat analogue to make possible solutions of thermal circuits that include equipment characteristics and control programming, and (2) development of a computational procedure that will simplify the work of application engineers in predicting the true peak cooling load on the air-conditioning equipment.

Since the TAC was activated, Laboratory personnel have completed a paper entitled Analysis of Air-Conditioning Thermal Circuit by an Electronic Differential Analyzer. This paper has been approved and is expected to be presented at the next Annual Meeting. Another paper on the thermal analysis of a glass block panel is in the final stages of preparation.

Future Possibilities

Although principal emphasis will be on cooling loads during the immediate future, extension of thermal circuit techniques to other areas of air conditioning is also being considered. Some possibilities are: (1) effect of automatic controls on system operation; (2) thermal performance of buildings not air conditioned; (3) moisture transfer through building materials; (4) sizing of air distribution systems.

*Chairman, ASHAE Technical Advisory Committee on Thermal Circuits.

R. M. CONNER RETIRES FROM A.G.A. LABORATORIES

Effective July 31, R. M. Conner retired from his position as consultant for the *American Gas Association* Laboratories after 41 years of service.

Mr. Conner has been a member of the Society since 1931 and has served as chairman of the TAC on Correlating Thermal

R. M. Conner

Research. He has also served on numerous other TAC committees including the TAC on Oil and Gas Burning Devices, the TAC on Direct and Indirect Radiation, the TAC on Gas Heating Equipment, the TAC on Fuels and the TAC on Air Distribution. He was also a member of the Committee on Research from 1945 to 1947.

Mr. Conner contributed largely to the gas industry. He served as the first director of the *A.G.A.* Laboratories whose original staff of four has since grown to over 200. He continued to serve as director of the Laboratories until 1947 and since that time has served as consultant.

BUREAU OF STANDARDS TO MOVE

The National Bureau of Standards is expected to relocate its Washington laboratories on a tract of approximately 550 acres of land near Gaithersburg, Md. The move will permit the Bureau to plan new buildings to replace present research facilities, which over the past 50 years have become inadequate for current needs. Plans for the site have been given to the National Capital Planning Commission and to the Regional Planning Council. It is expected that these groups will work with the Bureau in utilizing the land. Transfer of operations to the new location is expected to be completed in about five years. The new site will enable the Bureau to plan for a more up-to-date plant consistent with its continually increasing responsibilities.

HEAT LOSS FROM HEAD IMPORTANT IN ARCTIC

According to recent studies carried on for the Defense Research Board of Canada by Canadian physiologists, G. Froese and Dr. C. Burton of the University of Western Ontario, most of the body heat loss in extremely cold weather comes from a hatless head. In other words, in low temperatures, it is very important to keep the head carefully covered. This information is contained in a paper presented at a meeting of the *Federation of American Societies for Experimental Biology* held in April in Atlantic City, N. J.

DESIGN OF PIPING SYSTEMS

The second edition of this well-known book, written by members of the engineering department of the M. W. Kellogg Co., is planned to cover the entire subject of structural design (stress analysis) of piping.

The new edition is completely rewritten and substantially expanded. It covers evaluation of weight and wind stresses in addition to calculations of expansion stresses and reactions. The chapters on expansion joints, pipe supports and vibration present a comprehensive treatment of these subjects. Included are chapters covering: Strength and Failure of Materials; Design Assumptions, Stress Evaluation, and Design Limits; Local Components; Simplified Methods for Flexibility Analysis by Model Test; Approaches for Reducing Expansion Effects; Expansion Joints, Supporting, Restraining, and Bracing the Piping System; Vibration: Prevention and Control; History and Derivation of Piping Flexibility Analysis; Derivation of Acoustic Vibration Formulas, Charts and Tables.

Book is 8⅝ x 11¼ in. with 365 pages, published by John Wiley & Sons, Inc., price $15.00.

Journal Section

ACTIVITIES OF SOCIETY CHAPTERS

Our 63 chapters all have programs of great interest to their members covering a wide range of subjects. Outlined here are some of the events and topics from the chapter reports concerning some of their recent meetings. Establishment of the new chapter at Austin is recorded.

Austin, Tex., is 63rd Chapter

With its charter presented at a dinner meeting held at the Pioneer Drive-Inn on the evening of July 19th, the Austin Chapter came into formal existence. To grace the occasion and make it memorable, many members were present as guests from the Dallas, Houston and San Antonio Chapters, along with Past Pres. Reg. F. Taylor and Regional Director D. M. Mills. Pres. John W. James expressed the best wishes of the Council and the Society as a whole for the future success of this group of 43 members making up the new chapter. He also presented the charter to the new chapter president, B. E. Segall, Jr., and handed over to him a gavel as a gift from the Northern Alberta Chapter. President James has made this occasion the subject of his message on the President's Page (p. 124) of this issue of the JOURNAL.

Technical Talks

Most of the chapters make use of speakers on technical subjects as an important feature of their meeting programs. The record shows that recently, the following technical talks have been included in chapter programs. . . .Speaking on the subject of school design at the ARIZONA chapter, Zephryn Marsh, chairman, National School Facilities Committee, stressed the need for better school facilities. . . . Application of electronic equipment was the subject of a talk by C. M. Sanders, Jr., Minneapolis-Honeywell Regulator Co., Chicago, at an ARKANSAS chapter meeting. . . .Recent speakers at meetings of the BATON ROUGE chapter have been L. S. Doherty, Silentaire Co.; also a researcher from Louisiana State University covering development of incubator boxes for seedling sugar cane; and T. Merrill, Adair-Merrill, New Orleans, on air filtration. . . .Using as his subject Vibration Control, D. H. Vance, The Korfund Co., Inc., Long Island City, N. Y., discussed methods of reducing and eliminating noise when he presented his subject at the GOLDEN GATE chapter. . . .An illustrated talk on standardization of refrigeration equipment by the Armed Forces was presented by W. C. Whittlesley, Natick QMC Research and Development Laboratory, at the MASSACHUSETTS chapter, which chapter also had the pleasure of a paper on savings in industrial ventilation by Mr. Gravelin. . . .A colored film on manufacture of seamless steel tube was shown at the MEMPHIS chapter by Richard Weigle, National Tube Corp. . . .At recent meetings, the NEW MEXICO chapter had talks on non-destructive testing by Dr. Gerold Tenney, Los Alamos Scientific Laboratory; by Oscar Mehl, Carrier Corp., an illustrated presentation on the subject of adsorption refrigeration; and also by Donald Paxton on the subject of solar energy, especially its use in an office building now under construction. . . .A talk on application and sizing of various types of valves was the subject used by Vern Brown, Charles M. Bailey Co., when he spoke before the SACRAMENTO VALLEY chapter.

Chapter Elections

A number of chapters have elected and installed new officers recently. Among them, the following are noted:

ARIZONA: J. B. Hoaglund, president; E. P. Maxwell, vice president; F. W. Gabbard, secretary; G. L. Jackson, Jr., treasurer.

ARKANSAS: J. W. Thompson, president; H. H. Himstedt, vice president; K. A. Pettit, secretary; W. A. Bullard, treasurer.

CINCINNATI: R. G. Anderson, president; T. D. Reiley, vice president; C. P. Krantz, secretary; E. A. Sobolewski, treasurer. Board of Governors: Walter Rieger.

GOLDEN GATE: F. K. Crouch, president; Herb Duncan, vice president; J. B. Smith, secretary; T. R. Simonson, treas-

urer. Board of Governors: J. I. Sprott, R. C. Pribuss.

MASSACHUSETTS: W. G. Martin, Jr., president; E. L. Blair, vice president; B. H. Snow, secretary; R. F. Curry, treasurer. Board of Governors: C. D. Potter, R. B. Stevens, H. F. White. At the June meeting F. J. Butler was elected secretary to fill the vacancy caused by the death of B. H. Snow.

MIAMI VALLEY: J. B. Rishel, president; L. P. Brehm, Jr., vice president; R. B. Walcott, secretary; N. O. Mitchell, treasurer. Board of Governors: J. M. Schweiger, C. D. Weaver, R. J. Perkins, W. R. Budde, D. E. Tullis.

SACRAMENTO VALLEY: V. W. Thornburg, president; M. J. Delavan, vice president; S. W. Doolittle, secretary; J. A. White, treasurer. Board of Governors: R. A. Sarro, R. T. Andrews, W. B. Lander.

SOUTHWEST TEXAS: At May Meeting, Boone Crisp, president; C. L. Herndon, vice president; D. T. Kern, secretary; J. G. Ford, treasurer. Board of Governors: Martin Royer, E. C. Cravens and W. H. Peck. Mr. Ford asked to be relieved of the office of treasurer and at the June Meeting, Lee Ingle was elected treasurer.

UTAH: W. L. Stuewe, president; R. V. Oliver, vice president; W. C. Leslie, secretary-treasurer.

Chapter Notes

A committee of the ARKANSAS chapter has been appointed to consider a chapter project. . . .When the CINCINNATI chapter held its spring outing, the entertainment featured a radio skit put on by chapter members. . . .A much appreciated event in connection with ladies' night at the MIAMI VALLEY chapter was the showing of slides by Bernie Silverstein from his European trip. . . .The June meeting of the NEW MEXICO chapter took the form of a swimming party in Santa Fe. . . .Members of the NORTH TEXAS chapter enjoyed a summer party in mid-June and also featured an entertaining talk rather than a technical paper at its July meeting. . . .In late May, the SACRAMENTO VALLEY chapter put on its golf tournament.

• *SOUTHERN CALIFORNIA*: A very lively talk was given at the June meeting by Z. A. Marsh, director of school activities, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. Mr. Marsh is the national chairman of the School Facilities Council of Architecture, Education and Industry, and also president of the Associated Exhibitors of the National Education Association. Mr. Marsh spoke on *The Engineers' Responsibilities in Schoolhouse Planning*, and a vigorous question period followed his talk. He was introduced by W. J. Biggar, who was himself introduced by the program chairman, G. D. Lord.

Prior to Mr. Marsh's talk, W. O. Stewart officiated at the installation of the new officers and Board of Governors, introducing both the outgoing and incoming officers to the meeting. Presiding officer was the retiring president, J. L. McCullough, who thanked the committee chairmen and the committees for the excellent work done in the past year. Attendance 96.

NAMED LIFE MEMBERS

C. Raymond Morris, Paterson, N.J.—Since the beginning of World War II, Mr. Morris has been connected with the Paterson Supply & Engineering Co., Paterson, N.J., as a sales engineer.

His birthplace is Sag Harbor, N. Y. Mr. Morris was employed by Dooley & Murray beginning in 1909. He later acted as an inspector for the Bureau of Buildings, New York, N. Y., for a few years previous to joining the United States Radiator Corp. in the same city in 1917. After 4 years in this employ, he became associated with the A. & J. Friedman Supply Co., Passaic, N. J., in charge of their heating department. In 1937 he started as president of his own company, Power & Heating Equipment Sales, Inc., Nutley, N. J., which he has continued ever since.

Mr. Morris joined the Society in 1921. His home is in Nutley.

C. R. Morris

Charles W. Wheeler, Akron, Ohio—A past president and charter member of the Pittsburgh Chapter, Mr. Wheeler became active in Society affairs shortly after joining in 1916. He participated in the solicitation of funds to start the Research Bureau. When the Pittsburgh Chapter was formed in 1919, he began 3 years of service as its secretary. He was elected vice president for 1924 and president, 1926. He was also a member of the board of governors in 1922, 1927 and 1931.

C. W. Wheeler

Mr. Wheeler was born in Omaha, Nebr., and attended school in Toledo, Ohio. He began his career in the engineering department, The American Pump Co., Battle Creek, Mich. In 1913 he joined the C. A. Dunham Co., in sales and engineering for their Detroit office. Four years later he became branch manager of the Pittsburgh office, C. A. Dunham Co. and the Ric-Wil Co. He was named assistant sales manager of the Ric-Wil Co., Cleveland, Ohio, in 1941 and six years later progressed to general sales manager, a position which he held until 1954. Mr. Wheeler presently is with the Akron Plumbing & Heating Co. of Akron, Ohio.

CANDIDATES FOR MEMBERSHIP

Listed here are the names of 51 men who are candidates for membership or advancement in membership grade.

Members are requested to assume their full share of responsibility of receiving these candidates into membership by advising the Executive Secretary before September 30, 1956, of any whose eligibility for membership is questioned. Unless such objection is made these candidates will be voted upon by the Council.

Note: †Reinstatement *Advancement

California (*Region* 4)

CARTER, H. C., Sr. Mech. Estimator, Division of Architecture, State of California, Los Angeles.

RICHARDSON, J. B., Chief Engr., J. S. Hamel, Engr., Burbank.

Colorado (*Region* 3)

MOORE, W. R., Br. Sales Mgr., National-U. S. Radiator Corp., Denver.

District of Columbia (*Region* 5)

HUME, G. G., Pres., General Engineering & Sales Co., Washington.

SHALLER, H. I., Mech. Engr., U. S. Corps of Engineers, Washington.

Florida (*Region* 5)

DENSON, W. C., Head of Mech. Sect., Wolpert, Tilden & Assocs., Orlando.

Illinois (*Region* 2)

BREX, I. E.†*, Design Engr., The Excelsior Steel Furnace Co., Chicago.

COLE, W. W. JR., Sales Engr., American Blower Corp., Rock Island.

GARBER, MORRIS, Co-Owner, Modern Plumbing Supply Co., Rock Island.

GARDNER, J. P., JR., Sales Engr., Joy Manufacturing Co., Chicago.

Iowa (*Region* 3)

BONICAMP, D. L., Sales Engr., Campbell Heating Co., Des Moines.

Kansas (*Region* 3)

MIKESELL, J. C.*, Dist. Engr., S. A. Long Co., Inc., Wichita.

Louisiana (*Region* 5)

CROSBY, RALPH, Engr.-Designer, Chesson, Forrest & Holland, Cons. Engrs., Baton Rouge.

ENGLISH, R. B., Br. Mgr., York Corp., Com. Div., New Orleans.

STALL, H. N.*, Pres., Lamatt Agency, Inc., New Orleans.

Maryland (*Region* 5)

HELLWIG, C. R., Sales Mgr. & Appl. Engr., General Automatic Products Corp., Baltimore.

HOLLIDAY, R. R., Chief Mech. Engr., Plant Engrg. Br., United States Government, National Institutes of Health, Bethesda.

Massachusetts (*Region* 1)

JENNER, C. R., Sales Engr., Boston York-Shipley Inc., Westwood.

Mississippi (*Region* 5)

SCHMALZ, G. H., Sales Engr., Minneapolis-Honeywell Regulator Co., Jackson.

Missouri (*Region* 3)

GARRETT, W. M., Sales Engr., General Heating & Cooling Co., Kansas City.

Nebraska (*Region* 3)

SCOTT, R. W., Mech. Engr., United States Air Force, Offutt Air Force Base.

New Jersey (*Region* 1)

EMMANS, R. S., Secy., Household Engineering Co., Branchville.

GREENE, J. D., Sales Engr., Johnson Service Co., Union.

JOHNSON, C. W., Sales Engr., Johnson Service Co., Union.

PERELLI, C. A.*, Mech. Engr., Herbert Fox, Cons. Engr., Newark.

New Mexico (*Region* 6)

CHOATE, J. E.†, Special Agent, Mundet Cork Corp., Albuquerque.

New York (*Region* 1)

CANNON, J. D., Partner, Cannon, Thiele, Betz & Cannon, Niagara Falls.

EVANS, SAM, Partner, Pope & Evans, New York.

KAHN, ELLIOT, Chief Estimator, Imperial Sheet Metal Works, Inc., New York.

MCGUINNESS, W. J., Prof. of Architecture, Pratt Institute, Brooklyn.

SMITH, W. A., Sales Engr., Jenkins Brothers, New York.

Ohio (*Region* 2)

HEIDAMOS, J. A., Sales Engr., American Blower Corp., Toledo.

ROGERS, T. S., Technical Cons., Owens-Corning Fiberglas Corp., Toledo.

SHANCK, D. L.*, Br. Mgr., American Air Filter Co., Inc., Cleveland.

Oklahoma (*Region* 6)

SAIN, K. L.*, Owner, K. L. Sain Co., Enid.

Pennsylvania (*Region* 1)

EVANS, R. B., Production Line Mgr. Respiratory & Vtg. Equip., Mine Safety Appliances Co., Pittsburgh.

GLUMICICH, D. N., Job Coordinator, Limbach Co., Pittsburgh.

HEISTER, R. J., Field Service Engr., A. M. Byers Co., Pittsburgh.

Texas (*Region* 6)

COLLINS, P. T., Mech. Engr., Superior Enterprises, Houston.

FRICK, L. N., Service Mgr. & Dist. Construction, Carrier Corp., Dallas.

WATKINS, R. M.*, Field Appl. Engr., Carrier Corp., Dallas.

Wisconsin (*Region* 2)

HUCK, A. H., Engr., A. P. Controls, Milwaukee.

MACARTHUR, A. A., Sales Engr., Johnson Service Co., Milwaukee.

PEARSE, R. H., JR., Sales Mgr., The Trane Co., La Crosse.

Journal Section

Canada (*Region* 7)

LIZOTTE, JEAN, Asst. Dist. Mgr., Trane Co. of Canada, Ltd., Quebec, Que.

MOFFITT, NOEL, Pres., Noel Moffitt Co., Ltd., Toronto, Ont.

MORE, I. G., Sales Engr., American-Standard Products (Canada), Ltd., Toronto, Ont.

WIGGS, C. W., Dist. Mgr., Trane Co. of Canada, Ltd., Quebec, Que.

Australia

BLIGHT, T. W., Designing Draftsman, A. E. Atherton & Sons, Pty., Ltd., Melbourne, Victoria.

Hong Kong

LIM, JOHN, Engr., American Engineering Corp., Hong Kong.

Philippines

AMANTE, I. R., Chief Engr., Del Rosario Brothers Inc., Manila.

OBITUARIES

ROBERT M. ROSEBROUGH
Webster Groves, Mo.

A Life Member of the Society, Robert M. Rosebrough, 73, who made his home in Webster Groves, Mo., died of a heart ailment at Deaconess Hospital on May 21. He retired two years ago from his position as central district manager for the L. J. Mueller Furnace Co., St. Louis, Mo.

An ASHAE member since 1920, Mr. Rosebrough served the St. Louis Chapter as secretary for two years previous to becoming second vice president in 1930. He was elected president of the Chapter for 1931, and the following year he served on the board of governors.

Mr. Rosebrough was born in St. Louis. He entered the heating profession in 1905, conducting his own business as a heating contractor for the five-year period following. After a few years in sales work, he became manager of the St. Louis Branch, L. J. Mueller Furnace Co., in 1913. He remained with the company 40 years.

Survivors include his wife, Florence; a daughter, Mrs. Florence Trobaugh; a son, John Stoddard Rosebrough, a Society member; three grandchildren and four great-grandchildren.

STEPHEN G. SWISHER, JR.
Milwaukee, Wis.

The Wisconsin Chapter has informed the Society of the death of Stephen G. Swisher, Jr., 62, on June 8 after a brief illness. His business was the Swisher-Hessler Co., Milwaukee, Wis.

Mr. Swisher, who was born in La Grange, Ill., began his career in sales work for Westinghouse Electric Manufacturing Co., Commonwealth Edison Co., and Ilg Electric Ventilating Co., all of Chicago. In 1919 he became vice president and director, Ohio Utilities Engineering Co., Springfield, Ohio, and the following year saw him as president of Swisher, Maurer & Co., Milwaukee, a position which he held for ten years. Later he became vice president, secretary and treasurer of the Badger Radio Corp., Milwaukee. He carried on his own business again for a few years, under the name of Swisher Corp., before joining The Trane Co. as branch manager of its Milwaukee office in 1934. He remained with The Trane Co. until late last year.

His wife, who resides in Milwaukee, survives.

ERNEST W. McMULLEN
Boston, Mass.

Ernest W. McMullen, partner, Gauteaume & McMullen, Boston, Mass., died on May 6 at the age of 66. Mr. McMullen had been a member of the Society since 1942.

Born in Roxbury, Mass., Mr. McMullen pursued a technical education at Lowell Institute, and Columbia and Rutgers Uni-

versities. He was first employed by Francis W. Wilson, as draftsman and designer. In 1912 he joined Monks & Johnson, where he served progressively as draftsman, resident engineer, chief draftsman, and executive engineer, becoming a partner in 1925. Eleven years later, he entered the partnership of Ganteaume & McMullen. Mr. McMullen, a registered engineer in Connecticut and Rhode Island, belonged to *ASCE* and *ACI*.

JOHN THOMAS DAVIS
Houston, Tex.

John Thomas Davis, 53, manufacturers representative, Houston, Tex., died suddenly of a heart attack on May 24. He had been a member of the Society for over ten years.

Mr. Davis was born in Shawnee, Okla. He attended the Oklahoma Baptist University, Shawnee, and Oklahoma University, Norman, Okla. After gaining his early experience as a draftsman with Joseph I. Davis, architect, Oklahoma City, Okla., he took his first engineering position with Federal Supply Co., also of Oklahoma City. In later years he was associated with R. K. Werner, consulting engineer, Fort Worth, Tex., and The Trane Co., La Crosse, Wis.

He is survived by his wife, Josephine.

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Mass.	Mass. (Boston)	G. D. Pile	W. G. Martin, Jr.
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Pa.	Philadelphia	E. K. Wagner	P. H. Yeomans
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Ohio	Cincinnati	A. H. Gerdsen	R. G. Anderson
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Mont.			
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Wash.	Inland Emp. (Spokane)	Max Tonn	F. W. Jenkinson

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Ky.	Bluegrass (Louisville)	W. M. Pace	W. J. Killian
La.	Delta (New Orleans)	J. H. Maloney	I. M. Richardson
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N. C.	So. Piedmont (Charlotte)	G. C. Garrett	W. P. Wells
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Va.	Virginia (Norfolk)	E. R. Simpson, Jr.	
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Ont.	Ottawa Valley (Ottawa)	W. J. Robinson	E. J. Schoenherr
Alta.	No. Alberta (Edmonton)	P. M. Butler	E. K. Cumming

(Continued from page 150)

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Committee for Revision of ASHAE Standard Code for Testing and Rating Return Line Low Vacuum Heating Pumps: W. M. Wallace, II, Chairman; H. E. Adams, H. S. Beam, A. H. Church, L. M. Nechine, E. G. Powell, A. O. Roche, Jr., D. W. Whittington.

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NRC—National Academy of Sciences, Div. of Engrg.: L. E. Seeley.

Nuclear Energy Engineering: R. A. Sherman, Chairman; W. F. Friend, W. A. Grant, L. N. Hunter, B. H. Jennings (Committee on Research).

Guide Advisory: C. E. Price, Chairman; R. E. Cherne, J. C. Fitts, P. B. Gordon.

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*Member of Committee on Research.

†Temporary Chairman.

ASHAE — OFFICERS OF CHAPTERS AND BRANCHES

(63 Chapters; 1 Special Branch; 6 Student Branches)

Date indicates year organized; an address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

ARIZONA

Arizona: 1953. Hdqrs., Phoenix. Meets, 1st Mon. PRES, J. B. Hoaglund, 1923 W. Osborn Rd. SECY, F. W. Gabbard, 111 East 14th St., Tempe.

ARKANSAS

Arkansas: 1952. Hdqrs., Little Rock. Meets, 3rd Tues. PRES, J. W. Thompson, 900 Center St. SECY, K. A. Pettit, 904 Wallace Bldg.

CALIFORNIA

Golden Gate: 1937. Hdqrs., San Francisco. Meets, 1st Thurs. PRES, F. K. Crouch, 906 Cerrito St., Albany (6). SECY, J. B. Smith, 1129 Folsom St.

Sacramento Valley: 1952. Hdqrs., Sacramento. Meets, 1st Wed. PRES, V. W. Thornburg, 2470 27th Ave. SECY, S. W. Doolittle, 581 Swanston Dr.

Southern California: 1930. Hdqrs., Los Angeles. Meets, 1st Tues. PRES, H. F. Ulovec, 3886 Olympiad Dr. (43). SECY, A. Z. Levine, 239 S. Oxford Ave. (4).

COLORADO

Rocky Mountain: 1944. Hdqrs., Denver. Meets, 1st Wed. PRES, A. S. Widdowfield, 1925 Blake St. (2). SECY, R. T. Beck, 1304 Cherokee St. (4).

CONNECTICUT

Connecticut: 1940. Hdqrs., New Haven. Meets, 3rd Thurs. PRES, Walter Heywood, 1007 Farmington Ave., West Hartford. SECY, R. B. Cahoon, 1326 Whalley Ave. (15).

DISTRICT OF COLUMBIA

Washington, D.C.: 1935. Hdqrs., Washington, D.C. Meets, 2nd Wed. PRES, J. H. Broome, 4926 Wisconsin Ave. (16). SECY, J. W. Morgan, 2117 M Street, N.W.

GEORGIA

Atlanta: 1937. Hdqrs., Atlanta. Meets, 2nd Mon. PRES, F. W. Bull, 1205 Spring St., N.W. SECY, J. S. Edgar, 2015 Peachtree Rd., N.W.

ILLINOIS

Illinois: 1906. Hdqrs., Chicago. Meets, 2nd Mon. PRES, H. G. Gragg, 228 N. LaSalle St. (1). SECY, Herbert Kreisman, 117 N. Desplaines St. (6).

INDIANA

Indiana: 1943. Hdqrs., Indianapolis. Meets, 4th Tues. PRES, A. O. Roche, Jr., 3950 Broadway (5). SECY, W. F. Currise, 619 Architects & Builders Bldg. (4).

IOWA

Iowa: 1940. Hdqrs., Des Moines. Meets, 2nd Tues. PRES, D. E. Schroeder, 2717 Cambridge. SECY, R. T. Howard, Jr., 220 Davidson Bldg.

KANSAS

Kansas: 1951. Hdqrs., Wichita. Meets, Tues. after 1st Mon. PRES, H. M. Skalla, 2639 Bennett (16). SECY, J. C. Mikesell, 5426 E. Pine (6).

KENTUCKY

Bluegrass: 1954. Hdqrs., Louisville. Meets, 2nd Mon. PRES, W. J. Killian, 215 Central Ave. (8). SECY, A. E. Handmaker, 500 Bergman Ave. (8).

LOUISIANA

Baton Rouge: 1955. Hdqrs., Baton Rouge. Meets, 3rd Wed. PRES, J. F. Naylor, Jr., 5363 Greenwell Springs Rd., P.O. Box 4688 Audubon Station. SECY, W. J. Le Blanc, 3185 Government St.

Delta: 1939. Hdqrs., New Orleans. Meets, 3rd Tues. PRES, H. N. Stall, 840 Baronne St. (12). SECY, O. F. Schully, 840 Baronne St.

Shreveport: 1948. Hdqrs., Shreveport. Meets, 3rd Thurs. PRES, R. S. Segall, 848 River Rd. SECY, A. L. Jones, Jr., 753 Gladstone.

MARYLAND

Baltimore: 1949. Hdqrs., Baltimore. Meets, 3rd Wed. PRES, W. G. Robertson, Jr., 2315 St. Paul St. (18). SECY, C. E. McCaffray, Huntingdon Ave. at 26th (11).

MASSACHUSETTS

Massachusetts: 1912. Hdqrs., Boston. Meets, 3rd Tues. PRES, W. G. Martin, Jr., 64 Moulton St., Cambridge (38). SECY, F. J. Butler, 77 Mill St., Weymouth (88).

Western Massachusetts: 1955. Hdqrs., Springfield. PRES, R. E. Cross, 114 Boston Rd. SECY, F. A. Ferraro, 172 Chestnut St.

MICHIGAN

Michigan: 1916. Hdqrs., Detroit. Meets, 1st Mon. after 10th of month. PRES, J. N. Livermore, 2000 Second Ave. (26). SECY, J. B. Olivieri, 37294 Ilene, Mt. Clemens.

Western Michigan: 1931. Hdqrs., Grand Rapids. Meets, 2nd Mon. PRES, F. L. Murray, 482 W. Michigan Ave., Battle Creek. SECY, R. J. Waalkes, 500 E. 8th St., Holland.

MINNESOTA

Minnesota: 1918. Hdqrs., Minneapolis. Meets, 1st Mon. PRES, E. T. Erickson, 500 Investors Bldg. (2). SECY, J. H. Jester, 621 E. Hennepin Ave.

MISSISSIPPI

Mississippi: 1953. Hdqrs., Jackson. Meets, 4th Mon. PRES, J. W. Doggett, Jr., 254 Kimbrough Dr. SECY, D. F. Ingram, 408 W. Fortification St.

MISSOURI

Kansas City: 1917. Hdqrs., Kansas City. Meets, 1st Mon. PRES, R. M. Spencer, 1510 Main St. SECY, J. E. Miller, 5830 Outlook, Mission, Kan.

St. Louis: 1918. Hdqrs., St. Louis. Meets, 2nd Tues. PRES, W. P. Norris, 6338 Waterman Ave.(5). SECY, J. J. Blackmore, 4030 Chouteau Ave. (10).

NEBRASKA

Nebraska: 1940. Hdqrs., Omaha. Meets, 2nd Tues. PRES, L. J. Paulsen, 1901 S. 39th St. SECY, E. N. Seiler, 1824 N. 53rd St.

NEW JERSEY

North Jersey: 1952. Hdqrs., Newark. Meets, 2nd Tues. PRES, W. C. Kruse, Jr., 183 N. 13th St. (7). SECY, S. H. Nitzberg, P.O. Box 157, Wood-Ridge.

NEW MEXICO

New Mexico: 1954. Hdqrs., Albuquerque. Meets, 3rd Mon. PRES, H. F. Munn, 419 Granite, N.W. SECY, J. K. James, 4462 Avenida del Sol.

NEW YORK

Central New York: 1944. Hdqrs., Syracuse. Meets, 4th Wed. PRES, H. J. Morton, 122 Lincoln Ave. SECY, E. L. Moyer, R. D. 2, Jamesville.

Empire State Capital: 1951. Hdqrs., Albany. Meets, 2nd Wed. PRES, G. G. Davis, 111 S. Church St., Schenectady. SECY, M. E. Waddell, 1623 Central Ave.

New York: 1911. Hdqrs., New York. Meets, 3rd Mon. PRES, J. B. Hewett, 64 Buena Vista Dr., Dobbs Ferry. SECY, Carl H. Flink, 62 Worth St. (13).

Western New York: 1919. Hdqrs., Buffalo. Meets 2nd Mon. PRES, V. N. Harwood, 250 Delaware Ave. (2). SECY, J. F. Bedard, 505 Franklin St.

NORTH CAROLINA

Northern Piedmont: 1952. Hdqrs., Greensboro. Meets, 2nd or 3rd Fri. PRES, L. R. Gorrell, 1412 Chester Rd., Raleigh. SECY, C. E. Amick, 1042 Oakmont Ave.

Southern Piedmont: 1952. Hdqrs., Charlotte. PRES, J. A. Rice, 719 E. Worthington Ave. SECY, E. D. Streng, P.O. Box 4083.

OHIO

Central Ohio: 1944. Hdqrs., Columbus. Meets, 3rd Mon. PRES, W. A. Schoonover, 2901 N. High St. (2). SECY, R. C. Liebert, 623 N. High St. (11).

Cincinnati: 1932. Hdqrs., Cincinnati. Meets, 1st Tues. PRES, R. G. Anderson, 1758 Elmore St. (23). SECY, C. P. Krantz, 2308 W. 8th St. (4).

Miami Valley: 1950. Hdqrs., Dayton. Meets, 1st Wed. PRES, J. B. Rishel, 397 W. 1st St. (2). SECY, R. B. Walcott, 2340 E. River Rd. (9).

Northern Ohio: 1916. Hdqrs., Cleveland. Meets, 2nd Mon. PRES, H. R. Canoyer, 1900 Superior. SECY, R. D. Wilson, 2142 E. 19th St. (15).

Toledo: 1954. Hdqrs., Toledo. PRES, J. F. Guest, 1815 N. 13th St. SECY, Robert Greenwald, 2525 Portsmouth Ave. (13).

OKLAHOMA

Oklahoma: 1935. Hdqrs., Oklahoma City. Meets, 2nd Mon. PRES, F. R. Denham, 320 Oklahoma Natural Bldg. (2). SECY, W. R. Johnson, 120 E. Main.

Northeastern Oklahoma: 1948. Hdqrs., Tulsa. Meets, 2nd Tues. PRES, H. W. Meinholtz, Box 2261. SECY, H. L. Cauvel, 3342 East 41st St.

OREGON

Oregon: 1939. Hdqrs., Portland. Meets, Thurs. after 1st Tues. PRES, W. R. Norte, 2225 N. E. Broadway (12). SECY, G. G. Van Aist, 947 S. E. Market.

PENNSYLVANIA

Philadelphia: 1916. Hdqrs., Philadelphia. Meets, 2nd Thurs. PRES, C. J. Lubking, 3345 W. Hunting Park Ave. (32). SECY, Ludwig Mack, 412 W. Horttter St. (19).

Pittsburgh: 1919. Hdqrs., Pittsburgh. Meets, 3rd Mon. PRES, R. M. Toucey, 223 Fourth Ave. (22). SECY, G. E. Smetak, 1238 Brighton Rd. (23).

SOUTH CAROLINA

South Carolina: 1954. Hdqrs., Columbia. PRES, J. E. McMurray, 1639 Blanding St. SECY, A. L. Blackstone, Jr., 1630 Laurel St.

TENNESSEE

Memphis: 1944. Hdqrs., Memphis. Meets, 3rd Mon. PRES, W. L. Henson, 496 S. Main St. SECY, G. B. Ramsey, Jr., 157 Neil St. (3).

TEXAS

Austin: 1956. Hdqrs., Austin. PRES, B. E. Segall, Jr., 705 N. Lamar. SECY, J. L. Rea Jr., 300 W. 8th St., P.O. Box 5206.

North Texas: 1938. Hdqrs., Dallas. Meets, 3rd Mon. PRES, H. G. Gregerson, 4512 Livingston (5). SECY, Ross Zumwalt, 929 Mercantile Securities Bldg. (1).

South Texas: 1938. Hdqrs., Houston. Meets, 3rd Fri. PRES, F. M. Neil, P.O. Box 13197 (19). SECY, A. B. Ullrich, 2520 Huldy St. (19).

Southwest Texas: 1946. Hdqrs., San Antonio. Meets 3rd Tues. PRES, Boone Crisp, Rt. 2, Box 421. SECY, D. T. Kern, 14 Chandler Bldg. (5).

West Texas: 1953. Hdqrs., Lubbock. Meets, 1st Tues. PRES, J. C. Wharton, P. O. Box 1240. SECY, D. G. Halley, 3608 Ave. A.

UTAH

Utah: 1944. Hdqrs., Salt Lake City. Meets, 3rd Thurs. PRES, W. L. Stuewe, 1472 S. State St. (4). SECY, W. C. Leslie, 307 W. 2nd St.

VIRGINIA

Virginia: 1946. Hdqrs., Norfolk. Meets, 3rd Wed. PRES, C. G. Conaway, Jr., 7454 Hank Ave. (5). SECY, E. R. Simpson, Jr., 720 Guy St.

WASHINGTON

Inland Empire: 1950. Hdqrs., Spokane. Meets, 1st Mon. PRES, Max Tonn, 4021 S. Latawah. SECY, R. D. Nevers, E. 124 Augusta, P.O. Box 5026 (21).

Pacific Northwest: 1928. Hdqrs., Seattle. Meets, 2nd Tues. PRES, L. F. Christofferson, 425-1411 Fourth Ave. Bldg. (1). SECY, H. M. Hendrickson, Mech. Engrg. Dept., University of Washington (5).

WISCONSIN

Wisconsin: 1922. Hdqrs., Milwaukee. Meets, 3rd Mon. PRES, H. K. Fortar, 1400 E. Park Pl. (11). SECY, H. W. Snyder, 5520 W. Burleigh (10).

CANADA

British Columbia: 1952. Hdqrs., Vancouver. Meets, 2nd Wed. PRES, D. W. Thomson, 1690 W. Broadway (9). SECY, W. F. Keenan, 54 W. Fifth Ave. (10).

Manitoba: 1935. Hdqrs., Winnipeg. Meets, 4th Thurs. PRES, A. H. Millar, 342 Mandeville St. (12). SECY, R. M. Fraser, 1855 Sargent Ave. (12).

Montreal: 1936. Hdqrs., Montreal. Meets, 3rd Mon. PRES, S. R. Plamondon, City Planning Dept., Smoke Control Division, City Hall. SECY, Arthur DeBreyne, 9 St. Denis St., St. Lambert.

Northern Alberta: 1956. Hdqrs., Edmonton. PRES, W. C. Woods, 13908 116 Ave. SECY, E. K. Cumming, 10249 104 St.

Ontario: 1922. Hdqrs., Toronto. Meets, 1st Mon. PRES, C. J. Bootes, 15 Torbarrie Rd., Downsview. SECY, H. R. Roth, Rm. 407, 57 Bloor St., W.

Ottawa Valley: 1952. Hdqrs., Ottawa. Meets, 3rd Tues. PRES, E. J. Schoenherr, 32 Clarey Ave. (1). SECY, C. W. Watson, 102 Bank St.

SPECIAL BRANCH

Switzerland: 1952. Hdqrs., Zurich. PRES, Walter Hausler, Erbstrasse 2, Kusnacht. SECY, L. F. de Bruyn, Heschgasse 45.

STUDENT BRANCHES

North Carolina State College: 1948. Hdqrs., Raleigh. PRES, P. K. Tuggle, 407 Gay St., Kannapolis. SECY, G. L. Waitman, P.O. Box 3790, North Carolina State College.

Oregon State College: 1949. Hdqrs., Corvallis. Meets, 1st Wed. after 1st Tues. PRES, P. I. Anderson, 202 N. 10th. SECY, D. W. Strahan, 233 Mall St.

Purdue University: 1948. Hdqrs., W. Lafayette, Ind. PRES, R. J. Puncochar, School of Mech. Engrg. SECY, G. T. Vail, Jr., School of Mech. Engrg.

Texas A. & M. College: 1946. Hdqrs., College Station. Meets, 2nd and 4th Tues. PRES, D. F. Carroll, Box 6264. SECY, C. W. Farrar, Jr., Rt. 1, Box 339, Bryan.

University of Detroit: 1949. Hdqrs., Detroit. Meets, 1st Tues. PRES, L. J. Hayes, Jr., 16254 Santa Rosa Dr. (21). SECY, E. F. Hoelscher, Jr., 14283 Cherrylawn (38).

University of Toronto: 1951. Hdqrs., Toronto. PRES, C. F. Smale, 347 Kennedy Ave. (9). SECY, T. D. Digel, 204 King St., Weston.

Johns-Manville organizes to give you better insulation service

New and separate insulations division created to provide industry greatly improved Sales and Engineering service to meet modern problems

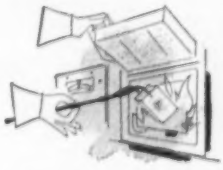
• Johns-Manville is now concentrating all industrial insulation operations within a new, fully integrated insulations division. This greater specialization makes possible the most complete insulation service available to industry. It consists of—

Sales Representatives . . . men on whom you can rely for your insulation recommendations. Your J-M salesman will help you select the insulating material exactly right for your job—the one that will provide maximum fuel savings, improved process control, and minimum maintenance. As co-ordinator of J-M's extensive research-engineering-manufacturing facilities, he offers you outstanding insulation training and experience.

Insulation Engineers—Backing up the J-M salesman on every job is the J-M insulation engineer. He is primarily concerned with solving insulation problems. He recommends the economic thickness of insulation, as well as the proper finishes, weatherproofing and securement. His highly specialized knowledge makes possible an intelligent recognition and handling of your individual insulation requirements.

Insulation Contract Units . . . Fully aware that no insulation is better than the man who applies it, the J-M Insulation Contractor makes care and skill in the scientific application of Johns-Manville insulations his stock in trade. He maintains a complete crew of estimators and mechanics trained in J-M application techniques. He is ready to give you fast, efficient service on any insulation job—large or small. Proud of his reputation for integrity in his own community, the J-M Insulation Contractor merits your complete confidence.

Complete Range of Products—In this day of exacting temperature control, the need for specific insulations for specific services is greater than ever before. Recognizing this, Johns-Manville manufactures insulations for every industrial requirement. Produced from the finest grades of asbestos, magnesium carbonate, diatomaceous silica, refractory clays and ceramic fibers, they are designed to afford maximum insulating effectiveness and durability at operating temperatures ranging from minus 300F to plus 3000F.



Extensive Research Facilities—At Manville, New Jersey, Johns-Manville maintains the world's most completely equipped insulation laboratory. Here insulation scientists are engaged in a continuous program of developing new and better insulating materials. In addition, their technical knowledge is always available to J-M customers whose insulation problems require special study.

Experienced Management—At headquarters as well as in the field, management of the new insulations division consists of men who, in line with J-M's promotion-from-within policy, are insulation veterans. With a realistic grasp of customers' needs, they are alert to new and better ways to serve you . . . now, and in the future.

On Your Next Insulation Job—Whether your next insulation job is big or little, simple or complex, let Johns-Manville handle it for you. Just call your nearest J-M sales office, or write direct to Johns-Manville, Box 14, New York 16, New York. In Canada, Port Credit, Ontario. *Chances are, you'll be glad you did!*

Johns-Manville *first-in* **INSULATION**

MATERIALS · ENGINEERING · APPLICATION

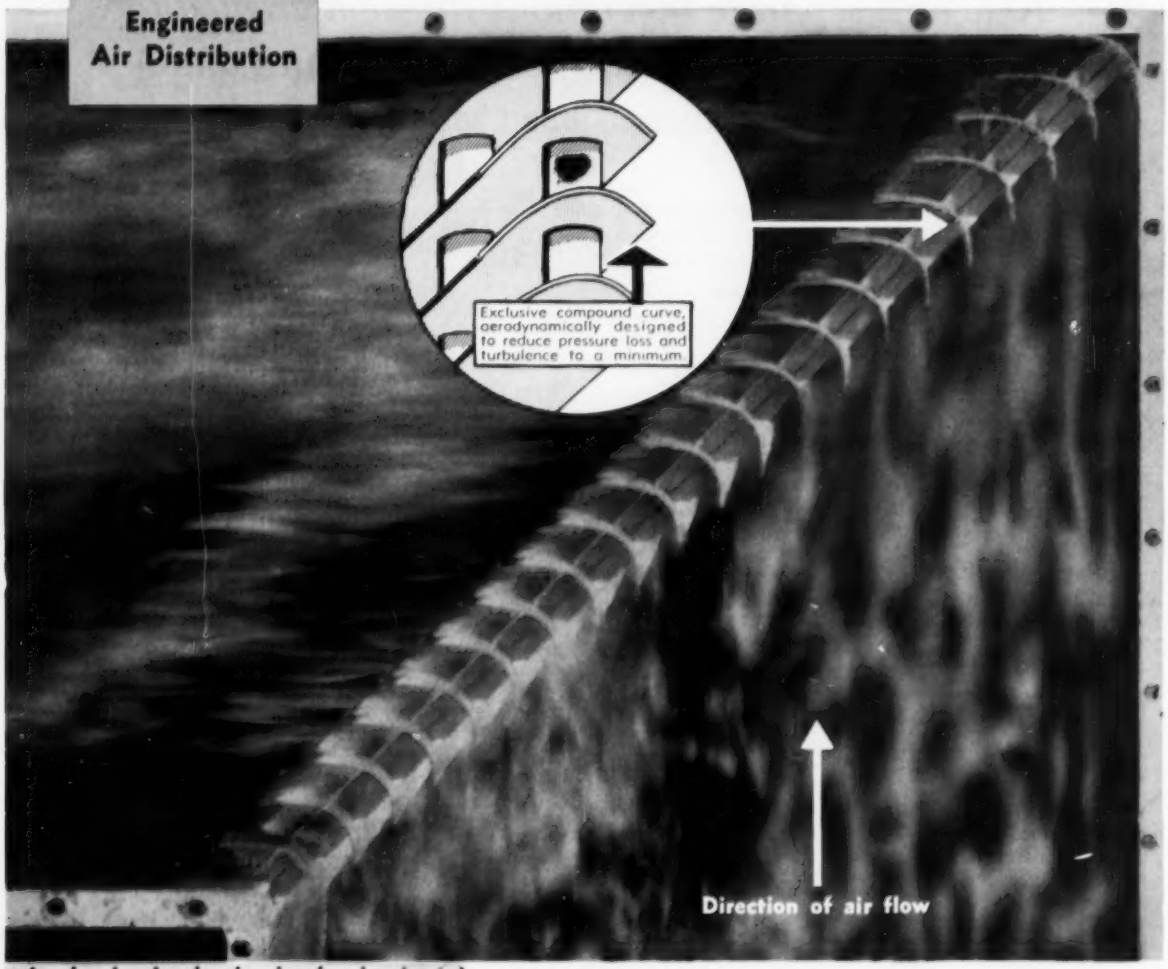
THE MARK OF QUALITY

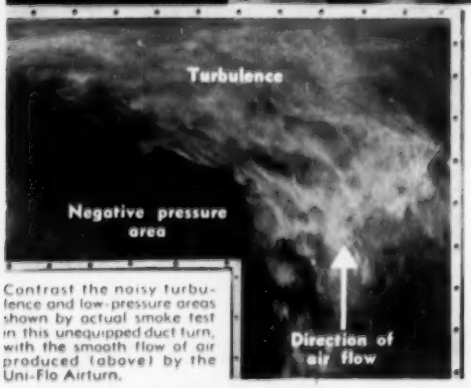
BARBER COLMAN

uni-flo

Engineered Air Distribution

Multiple-radius vanes of Uni-Flo AIRTURN® make air behave in ducts


Exclusive compound curve, aerodynamically designed to reduce pressure loss and turbulence to a minimum.
Direction of air flow

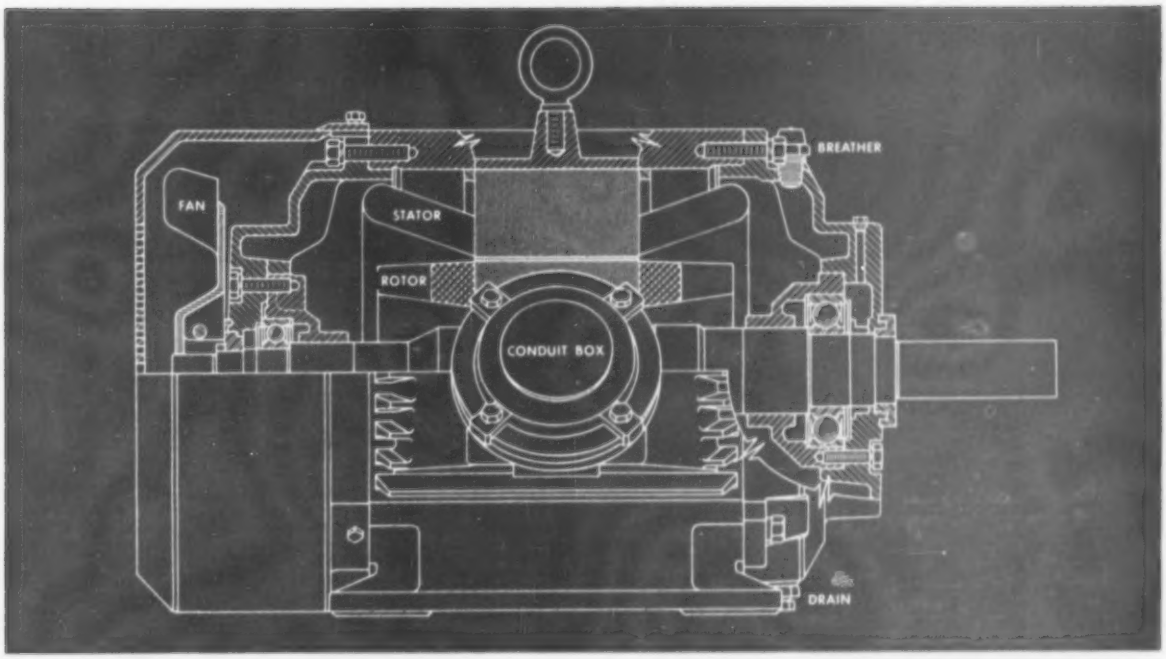


Contrast the noisy turbulence and low-pressure areas shown by actual smoke test in this unequipped duct turn, with the smooth flow of air produced (above) by the Uni-Flo Airturn.

For minimum noise and maximum efficiency of air movement in square duct turns, specify the Barber-Colman Uni-Flo Airturn. Laboratory data and field experience prove that the exclusive Barber-Colman vane design is the most effective available. The Uni-Flo Airturn gives sweeping radius performance to square duct corners, permitting installation economy in ductwork and operating savings at the fan. Sturdy, rattle-free assemblies in sizes 48 in. x 48 in. immediately available, specific sizes made up to meet individual job requirements. Get complete specifications from our nearby Field Office or write us today.

Barber-Colman Company

DEPT. I, 1101 ROCK STREET, ROCKFORD, ILLINOIS, U. S. A.



THIS MOTOR CAN CUT YOUR HAZARDOUS ATMOSPHERE INSURANCE COST

Insuring facilities with electric motors in hazardous atmospheres is generally expensive or impossible without special motors. Reliance has developed a completely new, Underwriters' approved motor design, called explosion-proof, for hazardous locations. In fact this is the only motor design that meets all qualifications for class I, group D and class II, groups E, F and G without requiring modification.

This new motor incorporates all of the outstanding features of the standard Reliance Totally-Protected Motor. In addition, all Reliance Explosion-Proof Motors are built to corrosion-proof standards.

If you would like to have more information on what qualifies a motor for hazardous atmospheres, write for our new Explosion-Proof Motor Bulletin No. B-2409.

B-1806

NATIONAL ELECTRICAL CODE CLASSES OF HAZARDOUS LOCATIONS

CLASS I—Those in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures.

Group D—Atmospheres containing gasoline, hexane, naphtha, benzine, butane, propane, alcohols, acetone, benzol, lacquer solvent vapors, or natural gas.

CLASS II—Those which are hazardous because of the presence of combustible dust.

Group E—Atmospheres containing dust of aluminum, magnesium, or their commercial alloys.

Group F—Atmospheres containing carbon black, coal or coke dust.

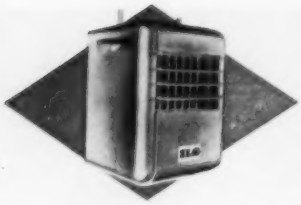
Group G—Atmospheres containing flour, starch or grain dust.

RELIANCE *Totally-Protected* MOTORS

RELIANCE ELECTRIC AND ENGINEERING CO.

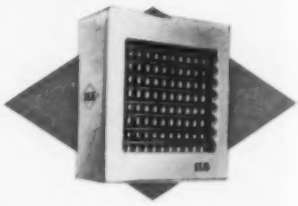
DEPT. 369A, CLEVELAND 10, OHIO • CANADIAN DIVISION, WELLAND, ONTARIO

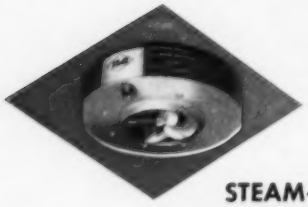
Sales Offices and Distributors in Principal Cities



GAS — Ilg gas fired unit heaters for use with all types of gases; natural, manufactured, mixed, Propane or Butane. 7 capacities from 25,000 to 200,000 BTU's.

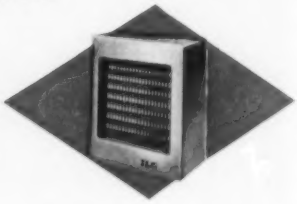
STEAM—Horizontal, available in 19 capacities from 21,000 to 286,000 BTU's.





STEAM—Vertical, available in 18 capacities from 34,200 to 596,000 BTU's.

STEAM—Textile Type, will not clog with lint, available in 10 capacities from 44,000 to 145,000 BTU's.



THE COMPLETE UNIT HEATER LINE

STEAM, GAS OR ALL ELECTRIC for ANY Plant, Store or Office

There's a unit heater in the big, complete ILG line that will meet your specific requirements . . . any type, any size, any style. Each is precision engineered and solidly constructed for quiet, dependable operation and easier installation. Warm, comfortable heating with greater efficiency, maximum safety is provided with a minimum of maintenance for a long operational life.

Whatever your need in heaters . . . steam or hot water, gas or electric, Ilg has the ideal model for the job. An Ilg Unit Heater will do the best job at the lowest cost . . . for the longest time!

ALL-ELECTRIC

New All-Electric Unit Heaters have black heat, non-glow type heating coil, are ideal for automatic heating. Heavy-duty capacities range from 1½ KW to 15 KW available for 115 and 230 volts, 5 KW sizes and up available for 440 and 550 volts.

ILG®

ILG ELECTRIC VENTILATING CO.

2850 N. Pulaski Road, Chicago 41, Illinois

Offices in 56 principal cities

TURNING POINT FOR SMOOTH, SILENT PERFORMANCE IN . . .

Air Conditioning

SEALMASTER
BALL BEARING UNITS

RUBBER MOUNTED CARTRIDGE

RUBBER MOUNTED FLANGE

RUBBER MOUNTED PILLOW BLOCK

SEALMASTER BALL BEARING UNITS

PILLOW BLOCK

TWO-BOLT FLANGE

FOUR-BOLT FLANGE

Smoother, quieter performance is the aim of every air conditioning manufacturer. SEALMASTER Ball Bearing Units with their exclusive combination of features are a major step in achievement of that goal. There's no surer way of adding quality and smooth, quiet performance to the air conditioning equipment you manufacture. The key to SEALMASTER'S added quality and performance are found in this exclusive combination of features.

ZONE HARDENING assures positive race to shaft holding power, minimizing vibration, eliminating shaft wear and reducing fretting corrosion.

LAND RIDING BALL RETAINER traps grease and prevents "churning"

LABYRINTH SEAL keeps dust and dirt out, lubrication in

LOCKING PIN AND PERIMETER DIMPLE prevents creep or spin of outer race ring in housing, eliminating housing wear, but permitting alignment of shaft and bearing unit.

Write for full information on these features and Bulletin 1253 on SEALMASTER Rubber Mounted Bearing Units for the Air Conditioning Industry.

SEALMASTER BEARINGS A DIVISION OF STEPHENS-ADAMSON MFG. CO. • 47 RIDGEWAY AVE., AURORA, ILLINOIS

Architect: Welton Becket, F.A.I.A. & Associates
General Contractor: Del E. Webb Construction Co.
Air Conditioning Contractor: F. B. Gardner Co.
Mechanical Contractor: Scott Co.

NEW CONCEPT OF HOTEL CONSTRUCTION known as total design integrates every element, from structural steel to the air conditioning system—Worthington air conditioning, of course.

New Beverly Hilton air conditioned by Worthington

Each room in the magnificent new Beverly Hilton has its own *individually controlled* air conditioner, consisting of a fan and coil unit. These fan and coil units supply year-round heating and cooling.

The entire 1000-ton system was selected after rigid tests under supervision of architect Welton Becket's staff. A pair of Worthington 400-ton centrifugal compressors and two 100-ton Worthington Packaged Water Chillers provide refrigeration for the complete air conditioning system. Worthington Corporation, Air Conditioning and Refrigeration Division, Section HP, Harrison, New Jersey. A-6-74

WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME

Owner: First Security Building Company, Salt Lake City
Architect: Bank Building and Equipment Corporation, W. G. Knoebel, registered architect, St. Louis, Mo.
Associate Architect: Slack W. Winburn, Salt Lake City
General Contractor: Utah Construction Company, Salt Lake City
Heating and Air Conditioning Contractor: Larsen and Company, Salt Lake City
Spang Distributor: N. O. Nelson Company, Salt Lake City

SPANG CW Steel Pipe handles the complete heating and air conditioning system in the new $3,000,000 First Security Bank Building at Salt Lake City, the first major building in Utah to use "skin-type design" construction.

"We know SPANG CW PIPE will give top service"

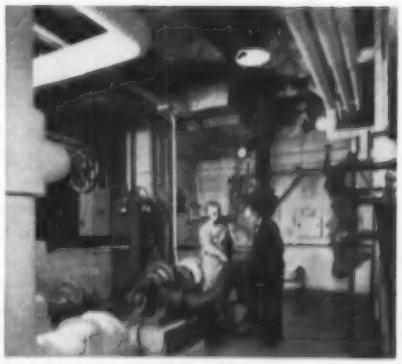
says Dick Brown, Manager,
Larsen and Company, Salt Lake City, Utah

That's the word from the man who is responsible for installing the heating and air conditioning system in the new First Security Bank Building at Salt Lake City, Utah. SPANG CW Steel Pipe was chosen for installation.

Mr. Brown says, "Our experience with SPANG CW Steel Pipe has been very favorable, and we do not hesitate to recommend it. It worked out very well in this new building, and we have no doubts it will give top service."

You'll hear this type of comment about SPANG CW wherever you go. Men who have worked with SPANG know from experience that it is a *top-quality* product, uniform in every respect, easy to install and will give years of trouble-free service in every type installation.

Why don't you cash in on SPANG's careful *quality-controlled* manufacturing? Make your next pipe order SPANG CW Steel Pipe. Let your nearby SPANG Distributor serve you!



Gerritt Van Leersum, building maintenance superintendent, explains the heating and air conditioning system to Robert E. Gullette, Vice President and General Manager of First Security Building Company. Top-quality SPANG Pipe serves the installation in this 12-story building.

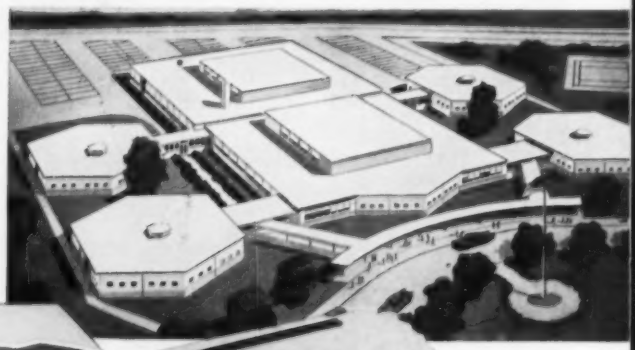
SPANG-CHALFANT
DIVISION OF THE NATIONAL SUPPLY COMPANY
General Sales Office: Two Gateway Center, Pittsburgh, Pa. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis

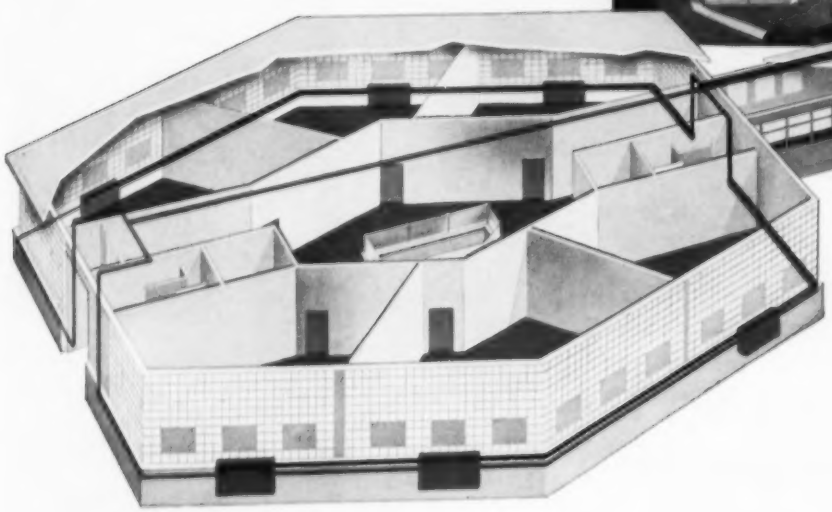
PROOF...

More Learning per School Dollar

through use of the Nesbitt Series Hot Water Wind-o-line System

This Nesbitt heating and ventilating system, with automatic temperature control, was installed in Lakewood High School at a cost of *$1.38 per square ft. of floor area!*





Lakewood High School, Lakewood, N. J.
Micklewright & Mountford, Architects
John Knecht, Mechanical Engineer
Maximum Capacity: 1000 pupils
Functional Capacity: 800 pupils
Gross Area: 86,240 square feet
Heating Contract: $118,787.00
Total Cost: $1,030,533.00

THE specification of the Nesbitt Series Wind-o-line System for Forced Hot Water Heating at Lakewood High School saved 2,400 feet of pipe trenches and 2,900 feet of additional mains and pipe covering when measured against a conventional steam system.

The Nesbitt Series Wind-o-line System effects these savings through the use of a unit ventilator radiator that delivers the required amounts of heat by multi-passing only one-third the usual amount of water—but at higher temperatures than is circulated by conventional hot water systems. This reduces the pipe size requirement to where the copper tubing of Wind-o-line Radiation can serve as the only supply and return piping for all the unit ventilators in an entire classroom wing, thus eliminating the need for mains, costly pipe trenches, coverings, and individual runouts to each unit.

Moreover, smaller water quantities mean smaller, less expensive pumps—with lower operating costs. And because the gravity heating effect of Wind-o-line Radiation and the Syncretizer radiator is sufficient to maintain overnight classroom temperatures, the cost of additional controls and equipment for that purpose is eliminated.

The Nesbitt Series Wind-o-line System means *greater comfort*, too! Since the system water temperature is varied by outdoor temperature, Wind-o-line's protection against cold surfaces and window downdrafts is continuously related to actual needs — helping to create the thermal environment most conducive to learning.

Nesbitt Heating and Ventilating offers you
MORE LEARNING PER SCHOOL DOLLAR
Write for further information

Nesbitt

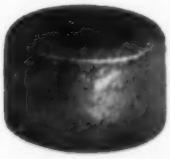
SERIES WIND·O·LINE SYSTEM

Manufactured and sold by John J. Nesbitt, Inc., Philadelphia 36, Pa. Sold also by American Blower Corporation and Canadian Sirocco Co., Ltd.

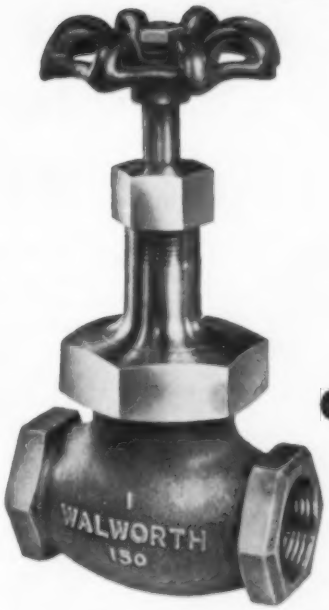
WALWORTH

Toothed Lock Washer: Prevents loss of stem nut due to vibration, thereby holding the handwheel securely.

Newly Designed Handwheel: Air-cooled, finger grip handwheel affords sure grip even with greasy gloves.



Improved Packing: Molded packing of lubricated asbestos reinforced with copper wire. Suitable for practically every service. Valves can be repacked under pressure.



IMPROVED
No. 95
BRONZE
GLOBE VALVE

also available in Angle Type (No. 96)

The service ratings of the Walworth No. 95 are 150 pounds per square inch steam at 500F, and 300 pounds per square inch non-shock cold water, oil, and gas. In the manufacture of this quality bronze valve, more than 47 gages are used in machining parts to micrometric accuracy, thus insuring interchangeability of parts. For further information see your local Walworth distributor, or write: Walworth Company, 60 East 42nd St., New York 17, N. Y.

note these 7 Great Features

Hexagonal Union Bonnet Connection: Eliminates any chance of distortion or leakage even though valve is repeatedly taken apart and assembled.

WALWORTH
valves and fittings

60 EAST 42nd STREET NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

New Cylindrical Disc Holder: The design of the top portion of the disc holder keeps the disc accurately guided under all operating conditions.

Renewable Asbestos Disc: This disc is suitable for steam up to 500F and is resistant to oil, gasoline, and many chemicals at atmospheric temperatures. Discs for special services are available.

Extra Strong Body: Made of Composition M (ASTM B61) bronze thick enough to provide a high safety factor. Valves undergo hydrostatic shell test of 450 psi.

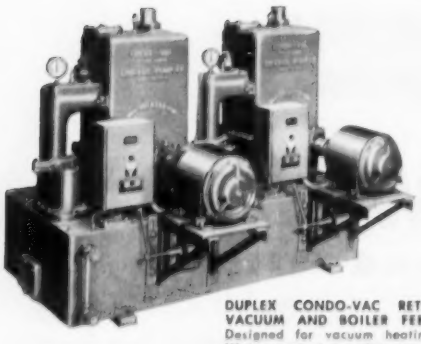
from "Chicago"

A SPECIFIC TYPE OF PUMP for every Steam Heating System

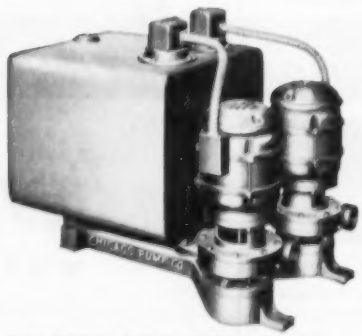
There's a Chicago Pump specifically designed for every type of building service steam heating system. No type of system has been overlooked by our engineers. *For any unusual condition; for below floor returns; for low vacuum systems; for small capacity, high pressure requirements; or for any standard system . . .* there is a Chicago Pump specifically designed 100% for the job. That means, there's no longer any reason for installing a pump that's not 100% suited to meet your needs. And you can be sure with a Chicago Pump that all ratings and receiver capacities meet or exceed standards of the American Society of Heating and Air Conditioning Engineers.

Write for details and free survey of your steam heating, pump requirements.

At left the TYPE AVC CONDENSATION PUMP & RECEIVER—Heavy cast iron receiver with low inlet for floor mounting or shallow pit. Cap. 500 to 10,000 EDR. Pressure 10-30 lbs.

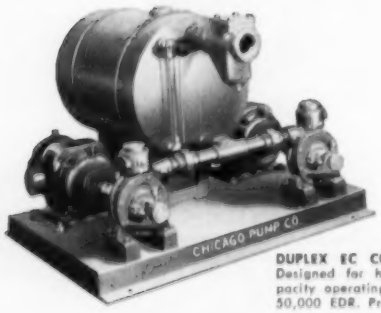


DUPLEX CONDO-VAC RETURN LINE VACUUM AND BOILER FEED PUMP—Designed for vacuum heating systems. Water content remains constant up to boiling point. Cap. 2500 to 150,000 EDR. Pressure to 40 lbs.



SURE RETURN CONDENSATION PUMP & RECEIVER — Condensate flows by gravity from receiver through base to pump. Available in single or duplex units. Cap. up to 75,000 EDR. Pressures, low or medium.

TYPE CLLI VERTICAL CONDENSATION PUMP & RECEIVER—Designed for low return service and underground installations. Cap. 1000 to 40,000 EDR. Pressures 10 to 25 lbs.



DUPLEX EC CONDENSATION UNIT — Designed for high pressure, small capacity operating conditions. Cap. up to 50,000 EDR. Pressures up to 150 lbs.

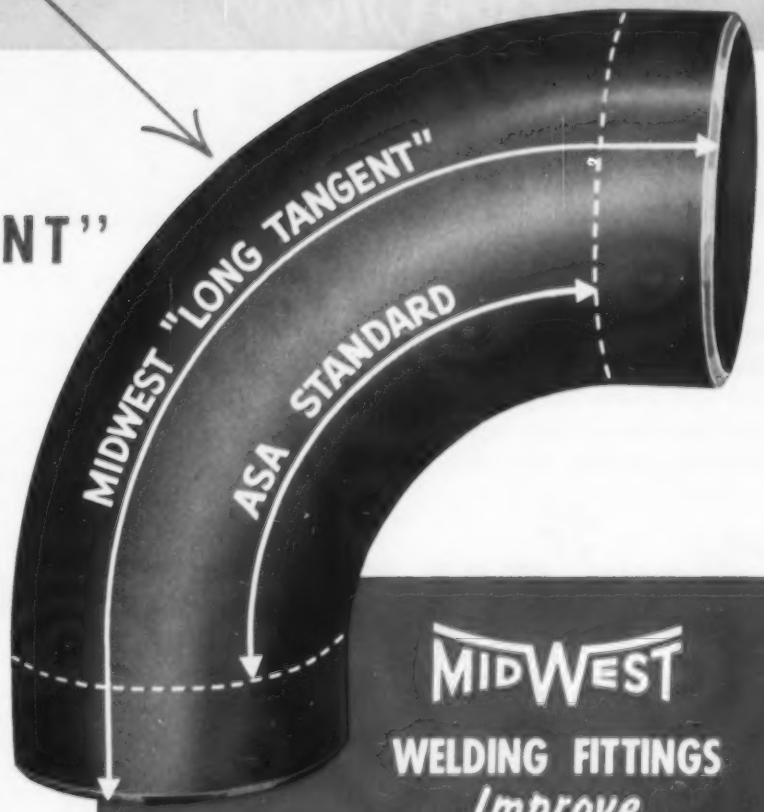
CHICAGO PUMP COMPANY
Subsidiary of Food Machinery and Chemical Corporation
BUILDING PUMP DIVISION
623 DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

Condo-Vac ®, Sure Return ®, AVC, LVC, Fire, House & Circulating Pumps, Pneumatic & Tankless Water Systems, Flush Kleen ®, Sewage Ejectors, Little Giant ® & Non-Clog Bilge Pumps. Pumps for every industrial use.

King Size (but at no extra cost)

MIDWEST

"LONG TANGENT" ELBOWS



Among all standard welding elbows, only Midwest "Long Tangent" Elbows can be described as *"King Size"* . . . only they have the long straight ends which equal ¼ of the nominal fitting diameter (a 12" Midwest "Long Tangent" Elbow has tangents 3" long). This greater length is responsible for significant savings on many piping systems (see advantages listed below). For additional information, ask your Midwest distributor or write us for Catalog 54.

MIDWEST PIPING COMPANY, INC.
Main Office: 1450 South Second Street, St. Louis 4, Mo.
Plants: St. Louis, Clifton, N. J. and Los Angeles

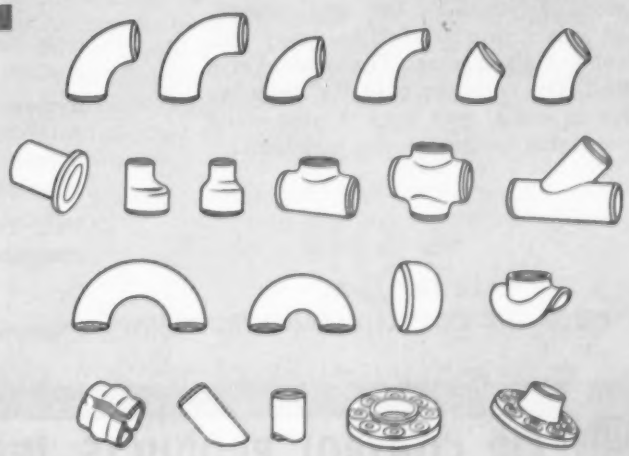
Sales Offices:
New York 7—50 Church St. • Chicago 3—79 West Monroe St. • Cleveland 14—616 St. Clair Ave. • Los Angeles 33—520 Anderson St. • Houston 2—1213 Capitol Ave. • Tulsa 3—224 Wright Bldg. • Miami 34—2103 Le Jeune Rd. • Boston 27—426 First St.
STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

MIDWEST

WELDING FITTINGS *Improve* PIPING DESIGN and REDUCE COSTS

ADVANTAGES OF MIDWEST "LONG TANGENT" ELBOWS

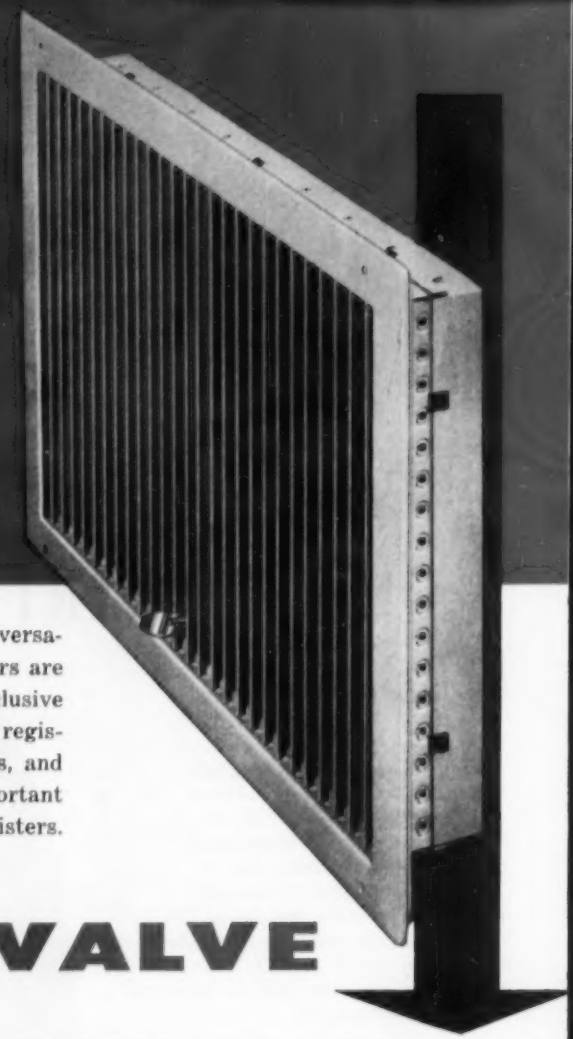
- ★ They save pipe.
- ★ They often eliminate short nipples and their extra welds.
- ★ They save time and money in lining up and clamping pipe and fitting.
- ★ They make it easier to apply slip-on flanges.
- ★ They remove the circumferential weld from point of maximum stress and can be sleeved.
- ★ THEY COST NO MORE THAN OTHER ELBOWS.



MIDWEST HAS THE MOST COMPLETE LINE

7323

MULTI-TROL
COMMERCIAL REGISTERS
by Air Control
GIVE YOU THIS BIG DIFFERENCE*

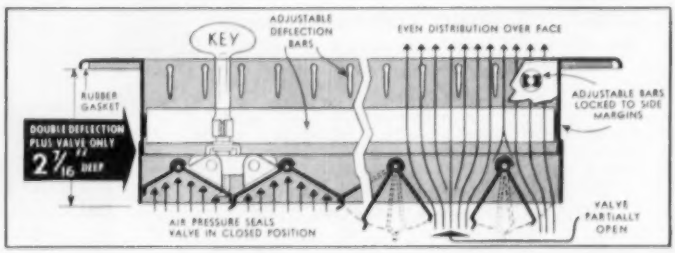


With Multi-Trol commercial registers you get performance and versatility no others can equal. Where ordinary commercial registers are too deep to be used with standard ducts, Air Control's exclusive Shallo-Valve solves the problem. Multi-Trol 4-way deflectional registers with Shallo-Valve can be installed in standard 3¼" ducts, and still leave ample space for adequate air flow. That's the important difference between Multi-Trol and any other commercial registers.

New* SHALLO-VALVE

EXCLUSIVE WITH MULTI-TROL COMMERCIAL REGISTERS

Multi-Trol Shallo-Valve louvers are the opposed-action type, designed to deliver air evenly over the face of the register at any velocity. When closed, air pressure seals the valve tightly, preventing annoying whistles. Adjustable bars and opposed-action valves provide positive 4-way control of the air stream. The Shallo-Valve of Multi-Trol registers, only 2½" deep, requires no special duct work in commercial or residential heating-cooling installations.


KEY
ADJUSTABLE DEFLECTION BARS
EVEN DISTRIBUTION OVER FACE
RUBBER GASKET
DOUBLE DEFLECTION PLUS VALVE ONLY 2 7/16" DEEP
ADJUSTABLE BARS LOCKED TO SIDE MARGINS
AIR PRESSURE SEALS VALVE IN CLOSED POSITION
VALVE PARTIALLY OPEN

Only Multi-Trol commercial registers by Air Control offer you all these advantages:

Key-operated Shallo-Valve — Minimum Air Resistance — Air Foil Contour Face Bars — Modern Styling with smooth, rounded corners — Handsome beige finish. Pivots of adjustable face bars are locked into margin, can't pull out.

Multi-Trol registers and grilles come in a wide range of sizes and styles for every need. See your favorite jobber.

WRITE FOR CATALOG 56-AC
SHOWING THE COMPLETE MULTI-TROL LINE*

**Patent Pending*

AIR CONTROL PRODUCTS, INC., Pace St., Coopersville, Mich.

"So Airtemp is Chrysler-Engineered—what's that to ME?"

AIRTEMP INSTALLATIONS

STUART INVESTMENT BUILDING
Lincoln, Neb. Contractors: Sidles Company. Built in 1937.

WAVERLY GROWERS CO-OPERATIVE
Waverly, Florida, Contractors: H. N. Webster, Sebring, Fla.

Airtemp
CONSTRUCTION CORPORATION
SUBSIDIARY OF CHRYSLER CORP.

CHRYSLER ENGINEERING MEANS EASIER INSTALLATION AND LESS COST

Installation of Airtemp is simple, easy, trouble-free—because Airtemp is *CHRYSLER-ENGINEERED!* **First,** Chrysler engineering means you specify exactly the type of air conditioning your clients need. **Second,** Chrysler engineering means Airtemp takes up less space, that it is flexible, that it provides individual room air conditioning when needed. **Third,** Chrysler engineering means less installation time and cost.

In short, Chrysler engineering means *peak* performance at *minimum* cost! Whisper-soft operation! Maximum cooling! Minimum maintenance! *All* the factors that spell air conditioning at its efficient best!

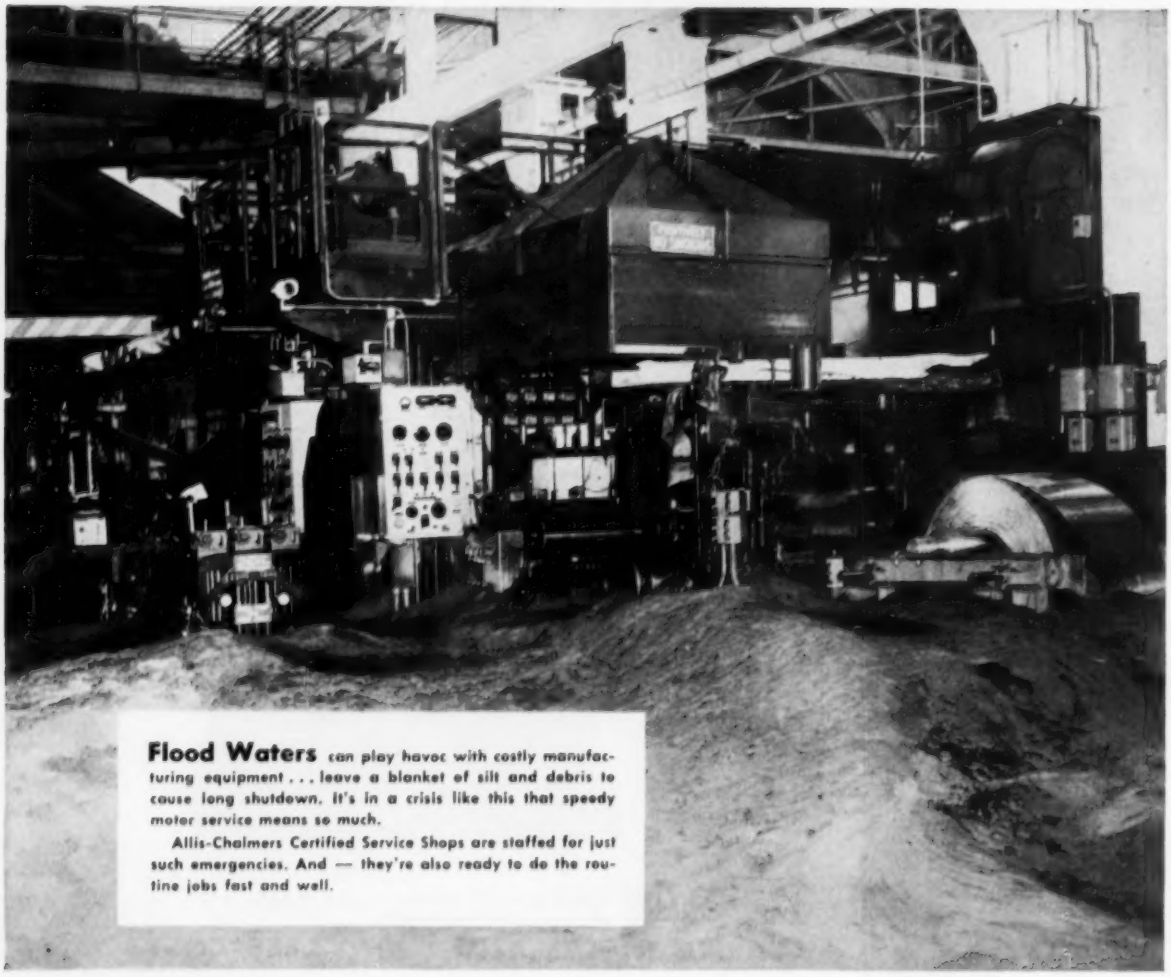
Write today for complete information.

Air Conditioning
FOR EVERY NEED IN HOMES, BUSINESS, INDUSTRY

AIRTEMP CONSTRUCTION CORPORATION, DEPT. HP-9-56·····DAYTON 1, OHIO

Allis-Chalmers "Certified" Service Shops:

When you need motor help



Flood Waters *can play havoc with costly manufacturing equipment . . . leave a blanket of silt and debris to cause long shutdown. It's in a crisis like this that speedy motor service means so much.*

Allis-Chalmers Certified Service Shops are staffed for just such emergencies. And — they're also ready to do the routine jobs fast and well.

Catastrophe or Routine Service

Whether it's complete catastrophe or a normal repair job, fast motor service can make a difference of thousands of dollars in lost production. As near as your phone is one of more than 100 Allis-Chalmers Certified Service Shops — ready to help save you production dollars.

These shops have manpower and equipment to perform repairs to Allis-Chalmers rigid standards. Their ability and integrity have been proven by years of service. They can do a good, fast job on any motor or generator, of any make. To locate the Shop in your area, call your nearby A-C district office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wis.

ALLIS-CHALMERS

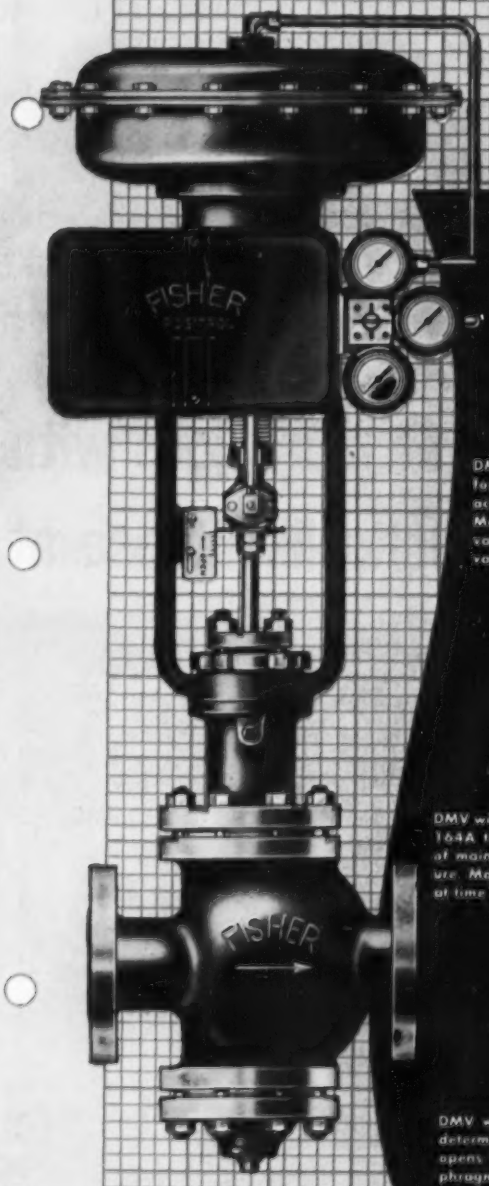
A-5140

FISHER®

THE ANSWER TO YOUR

Control Problem

Built for your specific requirements, Fisher Diaphragm Motor Valves are manufactured to handle pressure conditions up to 30,000 pounds, for high pressure drops and are available in metals for highly corrosive service and alloys for high temperature work.



TYPICAL EXAMPLES OF FISHER DIAPHRAGM MOTOR VALVE WIDE RANGE ADAPTABILITY

DMV with Hand Jack Operator. Allows for manual operation against spring action. Limits travel of valve. Example—Maximum opening in spring opened valve. Minimum closing in spring closed valve.

DMV with Continuously Connected Handwheel. Operator can open or close valve against controller action. Can operate valve manually if operating medium fails. Can set maximum opening or minimum closing of inner valve.

DMV with Air Lock-up system using Type 164A to close air circuit to diaphragm of main valve in case of plant air failure. Main valve will be held in position at time of supply pressure failure.

DMV with Remotely Actuated Electric Solenoid Trip Out. Valve may be fully opened or closed by unloading operating pressure from diaphragm by solenoid operation. Solenoid is actuated from manual switch or an electric tie-in circuit.

DMV with Air Cut-out Feature. At predetermined pressure setting, unloader opens and bleeds pressure off diaphragm to keep main valve open. Unloader orifice is larger than controller orifice so main valve remains open. Operation restored by putting thumb over open end of unloader.

DMV with Auxiliary Controller Override. An auxiliary controller, such as temperature, placed in operating air line to diaphragm—can over-ride action of main control function by unloading diaphragm and taking over functional operation of DMV.

FISHER GOVERNOR COMPANY

MARSHALLTOWN, IOWA • WOODSTOCK, ONTARIO

LEADS THE INDUSTRY IN RESEARCH FOR BETTER PRESSURE AND LIQUID LEVEL CONTROL

FISHER *Since 1880*

1 **New flexibility** permits conversion of room, floor, wing or entire building at one time with minimum crew. Radiator is removed and opening cut in the wall for new American-Standard Self-Contained Remotaire air conditioning unit.

2 **One-piece chassis** speeds installation. No central cooling plant, tower or ductwork is required. Self-Contained Remotaire has individual refrigeration circuit with air-cooled condenser which operates without water.

Save time—save labor—get more jobs with Air Conditioning Units like these at

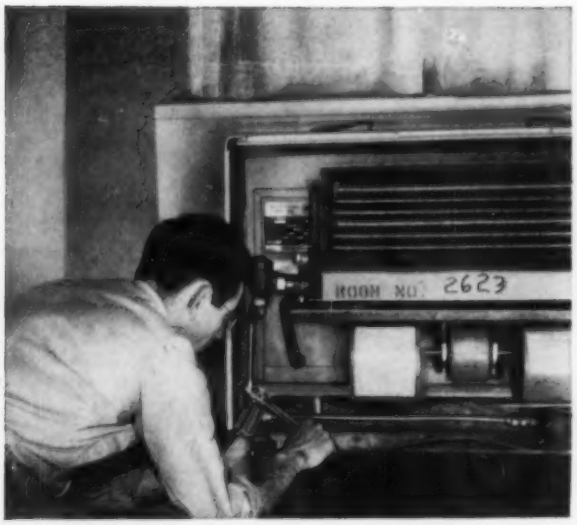
The Waldorf-Astoria, a Hilton Hotel, has this year installed year round air conditioning in 450 additional rooms with American-Standard Self-Contained Remotaire conditioners. *General Contractor: S. J. O'Brien Sales Corporation, New York.*

The flexibility of installation and operation of the new Self-Contained Remotaire Air Conditioning System by American-Standard makes every *existing* hotel, apartment and office building—plus *new construction*—a practical prospect for air conditioning. Such outstanding design features as one-piece chassis with insulated weather bulkhead, electrical connections pre-wired to the junction box, and simple hookup to the heating piping minimize installation time and costs.

• For complete details on the new, simple-to-install Self-Contained Remotaire, write AMERICAN-STANDARD, PLUMBING & HEATING DIVISION, 39 West 39th Street, New York 18, N. Y.

AMERICAN-Standard

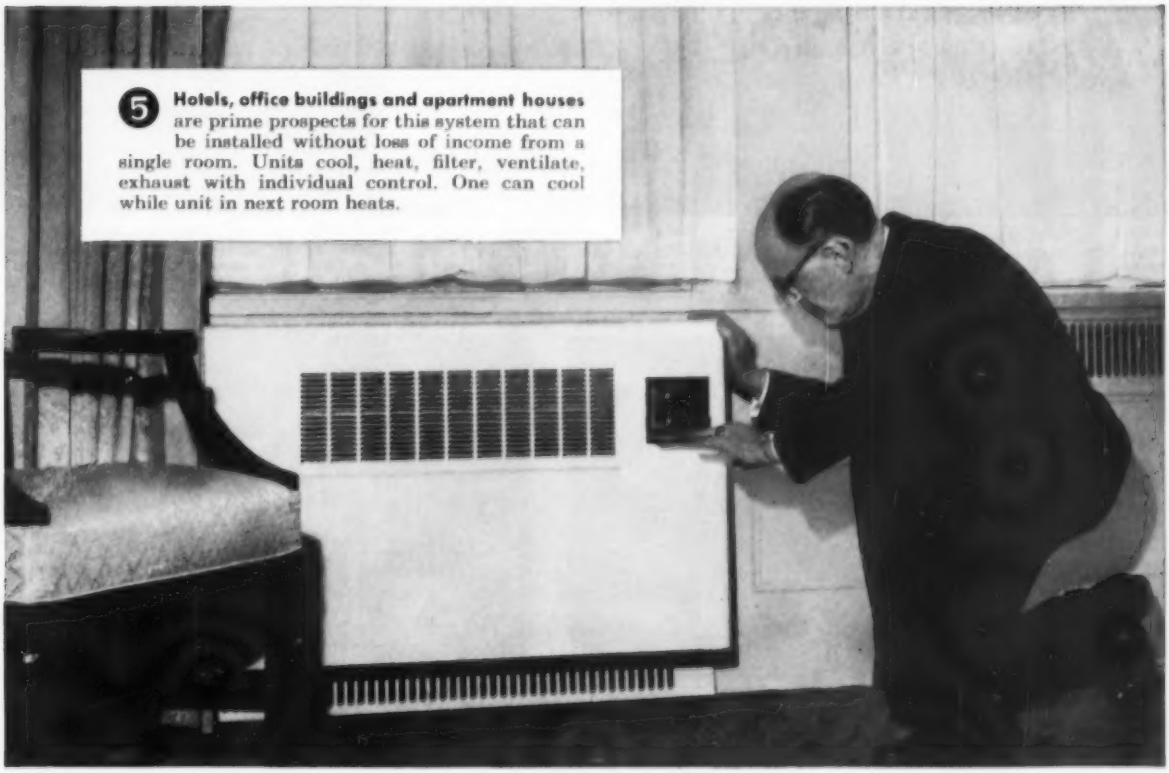
PLUMBING AND HEATING DIVISION



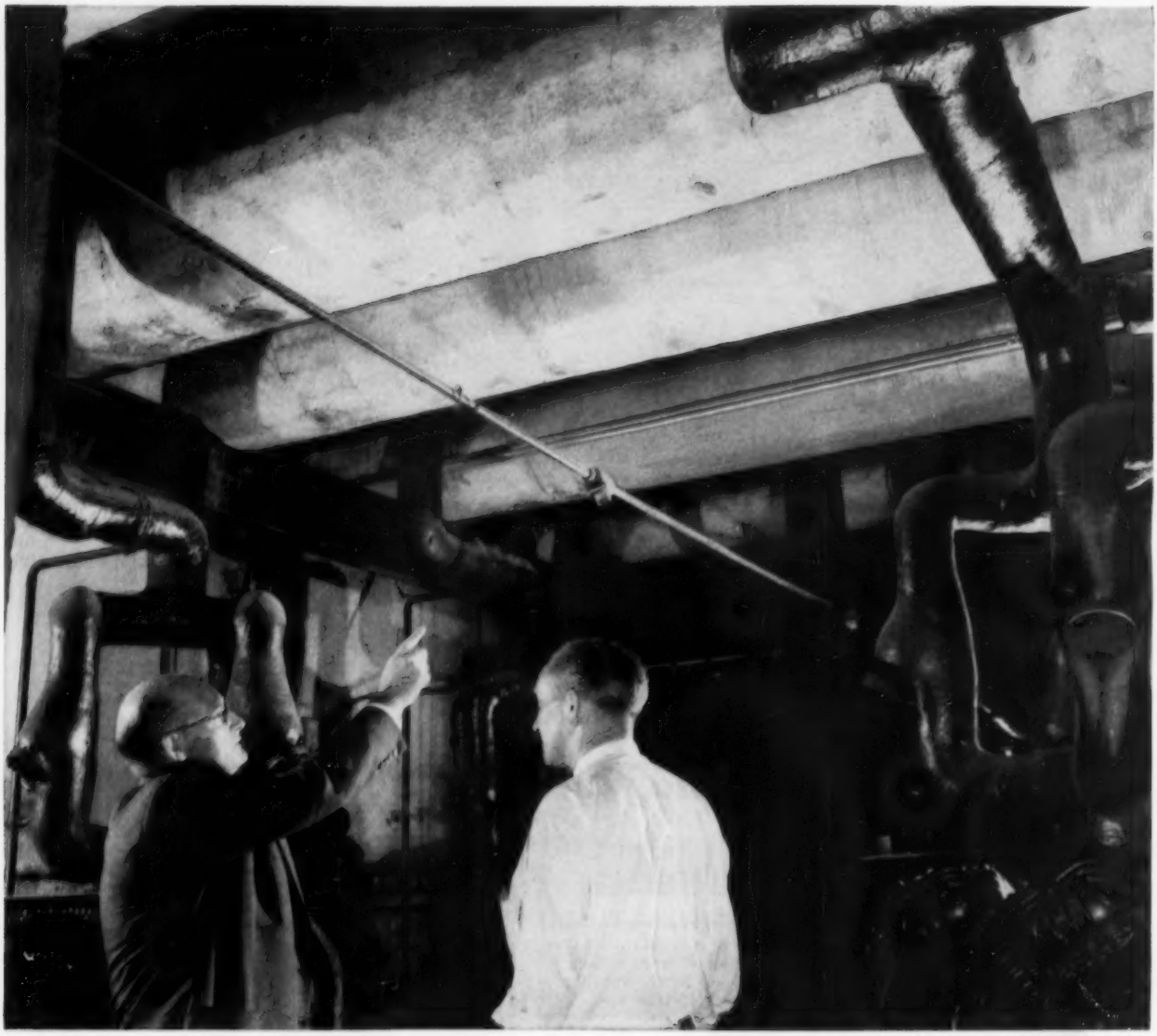
3 **Left- or right-hand** heating connections and lots of working space in cabinet facilitate easy hookup to existing pipes. For modernization, cabinet and wall sleeve come as one piece. For new construction, sleeve is detached—ready to be built into wall.

4 **Exterior of building** looks neat and trim. Weather-resistant, flush-fitting grilles are simple to install —leave no unsightly overhang. Available in ¾ hp (115-, 208- and 230-volt operation) and 1 hp (208- and 230-volt operation).

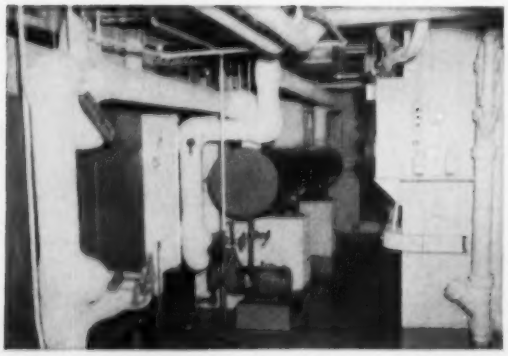
new AMERICAN-Standard Self-Contained the Waldorf-Astoria, a Hilton Hotel



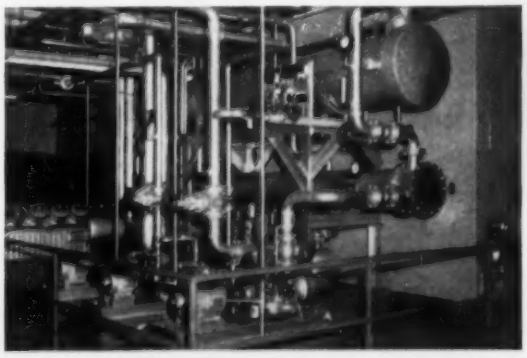
5 **Hotels, office buildings and apartment houses** are prime prospects for this system that can be installed without loss of income from a single room. Units cool, heat, filter, ventilate, exhaust with individual control. One can cool while unit in next room heats.



"They've never given us a bit of trouble," states Mr. R. E. Noll (left), Store Superintendent. With him is Mr. J. L. Quisenberry, Head of Maintenance for Wolf & Dessauer, who has been with the store since the eight Dry-Ex units were installed in 1937. The system, including eight 50 hp condensing units and 15 remote air handling units, air conditions the main building's seven floors. The system was installed by Hipskind Heating and Plumbing Company of Ft. Wayne.



MODERN DRY-EX CHILLERS do all kinds of air conditioning, refrigeration and industrial, direct-cooling jobs. This Dry-Ex air conditions the Anderson Loan Association building at Anderson, Indiana. The 50-ton system also utilizes an Acme evaporative condenser.



100-TON DRY-EX AND ACME FREON CONDENSER are major components of this Cincinnati, Ohio air conditioning installation in Western & Southern Life Insurance Company's modern office building. Two Acme Flow-Mizer® cooling towers allow constant re-use of condenser water.

19 YEARS OF TROUBLE-FREE SERVICE

First Acme Dry-Ex® Chillers still in operation in famous Indiana department store

Operating with full capacity and efficiency since 1937, eight Acme Dry-Ex Chillers in the Wolf & Dessauer department store, Ft. Wayne, Indiana have never required any maintenance other than routine cleaning. As a result, in almost 20 years of operation, this busy store has never lost a day's air conditioning through interruption of service by these Acme units.

In originating the Dry-Ex Chiller, Acme created a component for air conditioning and refrigeration systems that have withstood the tests of time and tough requirements in thousands of diverse applications. The fact that 80% of the direct expansion chillers in use today are of Acme manufacture is proof of industry-wide preference for the Dry-Ex.

Now More Efficient Than Ever

The modern Dry-Ex combines the dependability of Acme's thru-tube construction, proven in 19 years of broad field experience, with the added efficiency of an exclusive star-insert tubing. You receive more chilling capacity per dollar of investment than ever before.

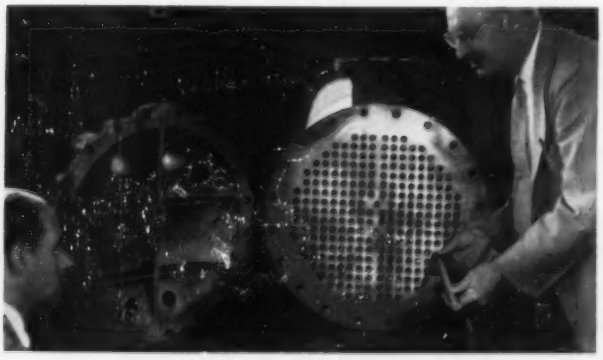
Acme custom builds Dry-Ex Chillers, utilizing standardized parts, to meet exactly the conditions of virtually any water chilling or other liquid cooling application. Capacities from 5 to 400 tons are available in single or multi-circuit units. Two model series, one with star-insert tubing and the other with plain tubing, are available. A wide range of baffle and head pass combinations make it possible to achieve ideal, controlled liquid velocities.

To Get Your Copy of Acme's data-packed Dry-Ex catalog, just send us this coupon attached to your letterhead

ACME AIR CONDITIONING REFRIGERATION

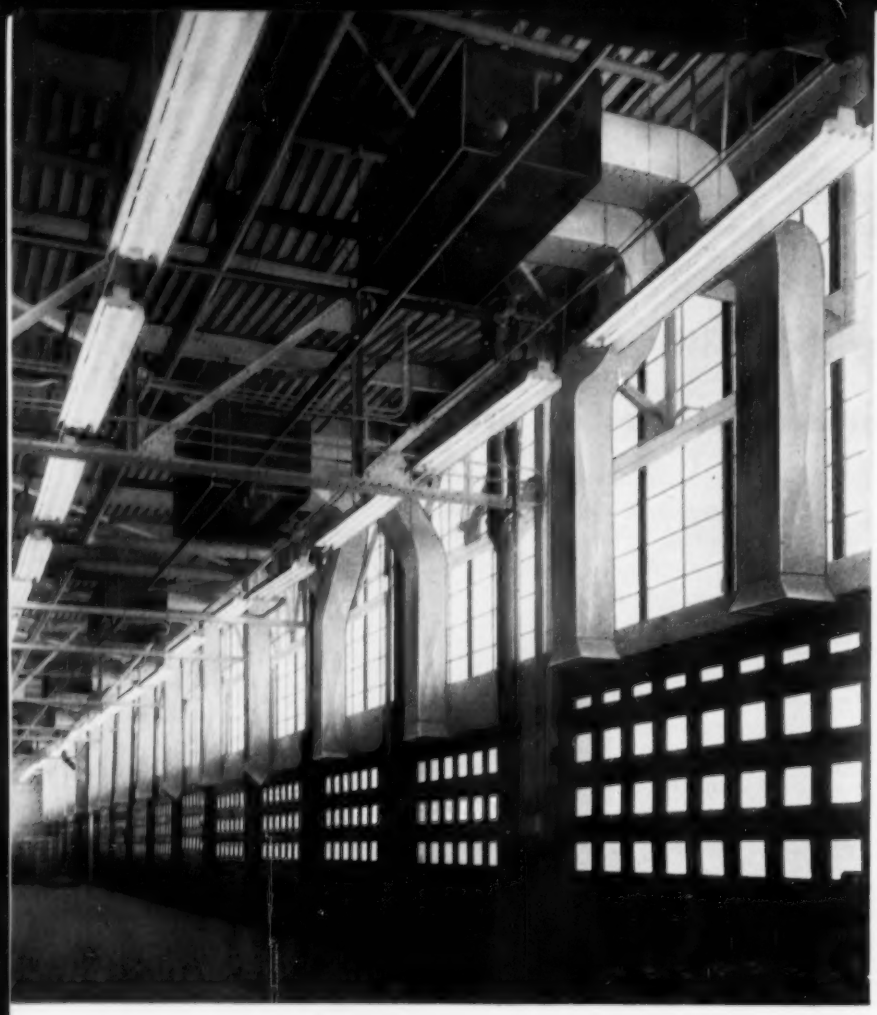
Acme INDUSTRIES INC. Jackson, Michigan

Manufacturers of Quality Air Conditioning and Refrigeration Equipment since 1919



ACME'S PROVEN THRU-TUBE CONSTRUCTION has tubes extending straight through to multi-pass heads at each end. No tubing bends — less pressure drop! No soldered joints — no leaks! With straight, unobstructed passages, high refrigerant velocity and positive oil return are achieved.

ACME'S EXCLUSIVE STAR-INSERT TUBING, a major advancement in chiller design, has more than twice the heat transfer of plain tubing. It means more chilling capacity per dollar in a smaller, lighter unit that is easier to install. Freight and handling costs are less, too.



1. **SIX HERMAN NELSON HEATING AND VENTILATING UNITS** blanket the Chrysler Corporation's Transmission Plant shipping department doorways. Suspended from the ceiling, they hang out of the way . . . provide quiet operation. Available in heat capacities ranging to one million BTU's.

Architects and Engineers:
ALBERT KAHN ASSOCIATED ARCHITECTS & ENGINEERS, INC.
Detroit, Michigan

Mechanical Contractor:
FREYN BROS., INC.
Indianapolis, Indiana

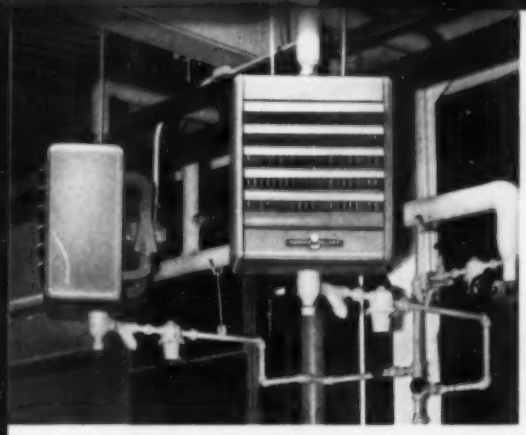
HERMAN NELSON heating and ventilating equipment chosen for new Chrysler transmission plant

Complete Herman Nelson line . . . at work in Kokomo:

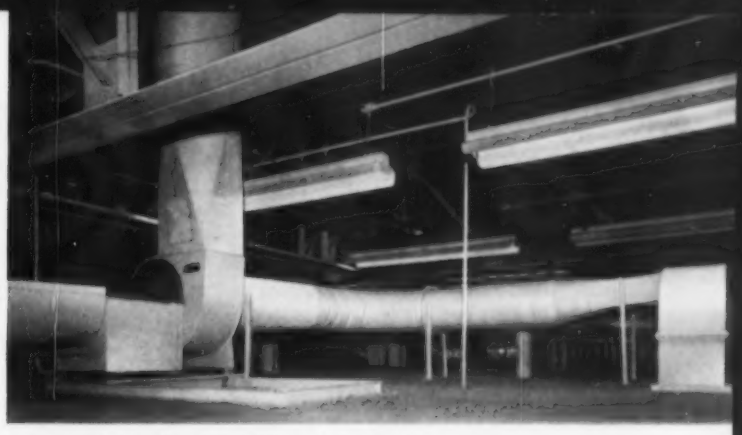
Heating and Ventilating Units
Unit Blowers
Vertical Unit Heaters
Horizontal Unit Heaters
Centrifugal Fans
Exhausters
plus AAF Air Filters and Dust Collectors, and Illinois Engineering Steam Specialties

When Chrysler Corporation planned its huge new automatic transmission plant at Kokomo, Indiana, it made certain that all departments would be properly heated and ventilated — and in the most efficient way possible. Selection of Herman Nelson equipment on such a plant-wide scale demonstrated Chrysler's confidence in Herman Nelson.

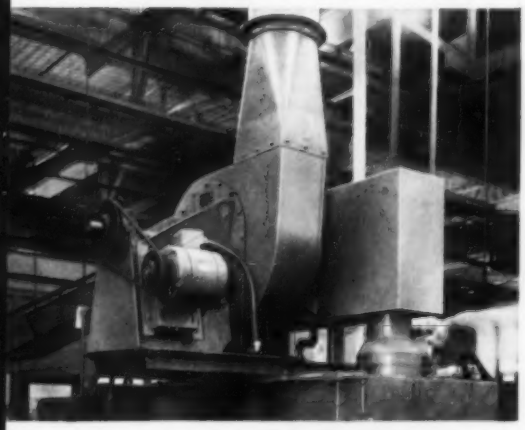
If yours is a problem requiring better air, remember . . . *better air is our business.* You can *depend upon* the quality, performance and efficiency of this *complete* line of air handling equipment. Call on our nation-wide sales and service organization for any help you need.



2. A PAIR OF HERMAN NELSON HORIZONTAL UNIT HEATERS blanket a window area in the penthouse storage area at the Kokomo, Indiana, plant. Using either steam or hot water, compact in design, these heaters are available in 18 sizes.



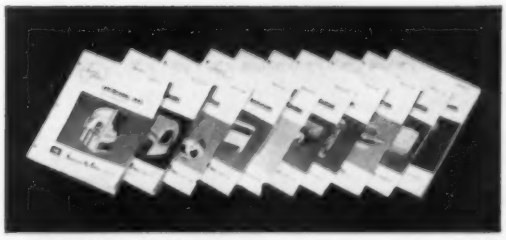
3. HERMAN NELSON UNIT BLOWER used for exhausting the manufacturing area. A completely "packaged" blower, easy to install, the unit features a hinged drive-side cover and outboard sheave that permits complete, easy-to-get-at servicing of belt and motor.



4. A NEW AAF TYPE K INDUSTRIAL EXHAUSTER provides high efficiency in various heat treating operations at the Kokomo plant. Exclusive Taper Lock Hub Assembly on this completely "packaged" unit allows fast, easy changeover on heavy-duty applications where periodic wheel replacement is anticipated. Eliminates the problem of impellers freezing to shafts.

5. HERMAN NELSON CENTRIFUGAL FAN supplying filtered and heated air to main factory area (hot blast system) at the Chrysler plant. AAF air filters and Illinois Engineering steam traps in system were included in this installation. The smaller unit in illustration is a Herman Nelson Unit Blower Size EBZK-1800, exhausting toilet space in penthouse.

6. A HERMAN NELSON VERTICAL UNIT HEATER with louver diffuser discharges air vertically downward or at angle in various directions. Located in the main factory area, it is high on the ceiling, out of the way, yet directing warm air, without drafts, wherever it is needed.



FREE . . . A wealth of useful data is available to you in these NEW, easy-to-read Herman Nelson catalogs. Request the ones you need on your business letterhead.

American Air Filter
COMPANY, INC.
373 Central Avenue • Louisville 8, Ky.

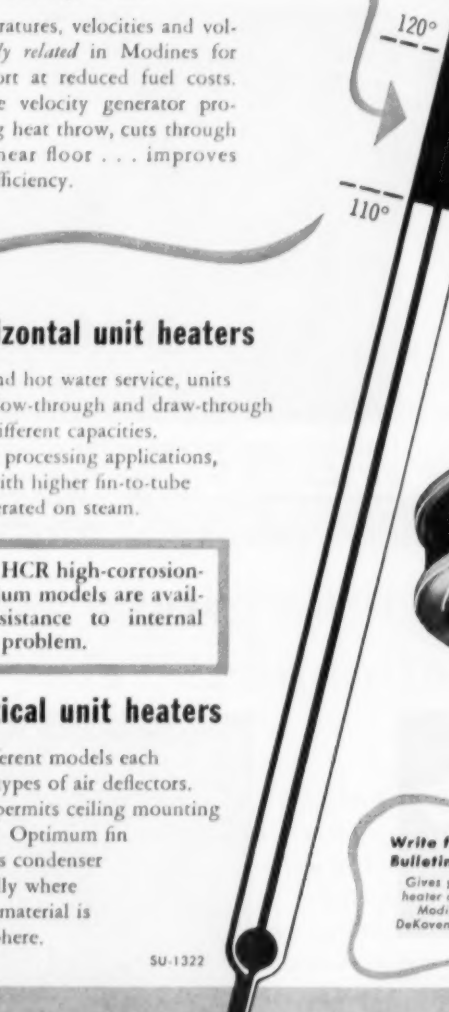
AAF

Better Air Is Our Business

You can expect
MORE COMFORT PER FUEL DOLLAR
from *Modine* UNIT HEATERS

Comfort-economy zone

Outlet air temperatures, velocities and volumes are *correctly related* in Modines for maximum comfort at reduced fuel costs. *Exclusive* Modine velocity generator produces penetrating heat throw, cuts through cold air strata near floor . . . improves overall heating efficiency.



Horizontal delivery type, direct pipe-suspended, can be installed as recessed or fully concealed unit.

Modine horizontal unit heaters

Built for steam and hot water service, units are available in blow-through and draw-through types . . . in 36 different capacities.

For drying and processing applications, hot water units with higher fin-to-tube ratios may be operated on steam.

Special Modine HCR high-corrosion-resistance premium models are available where resistance to internal corrosion is a problem.

Vertical delivery type. Light weight unit installs easier without special ceiling supports.

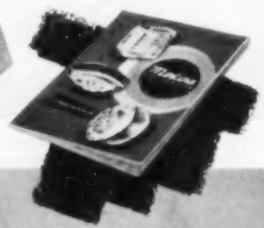
Modine vertical unit heaters

Offered in 26 different models each with choice of 4 types of air deflectors. Compact design permits ceiling mounting above craneways. Optimum fin spacing minimizes condenser clogging, especially where excessive foreign material is present in atmosphere.

SU-1322

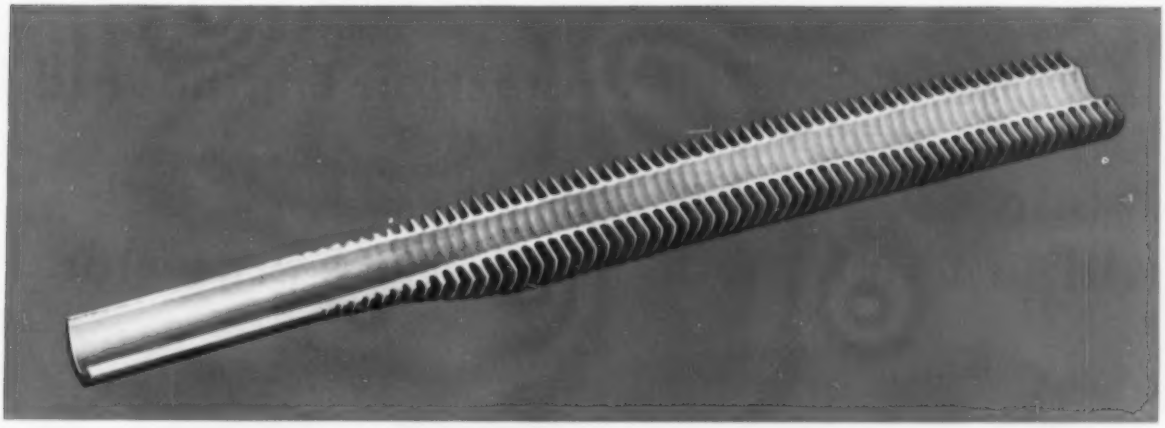
Write for free Bulletin 155

Gives you complete unit heater details. Write Modine Mfg. Co., 1509 DeKoven Ave., Racine Wis.



Modine UNIT HEATERS

In Canada: Sarco, Ltd., Toronto



WOLVERINE TRUFIN® The Integral Finned Tube

Wolverine Trufin —Big Step Forward in Heat Transfer

Probably the most significant advance in heat transfer applications came with Wolverine Tube's development of Wolverine Trufin—the integral finned condenser tube.

Trufin is an extended surface tube with fins squeezed directly from the tube wall. Because of this it has more than twice the heat transfer surface of plain tube—extracts more BTU's per foot of tube.

Wolverine Trufin is available in aluminum as well as in copper, copper-base alloys and electric-welded steel. Because its fins are actually part of the tube wall they are unaffected by vibration, temperature changes or pressure variations.

Trufin is available in five distinct types with fins varying in height and number per inch. High finned aluminum Trufin is particularly effective in air-cooled heat transfer applications.

FREE CATALOG BIG HELP TO MANUFACTURERS

A complete description of Wolverine Tube's product line and fabrication facilities is contained in the General Products Catalog. Your request will start it on its way to you without any obligation. Write today!

New Trends Noted:

ALUMINUM TAKES NEW FORM IN WOLVERINE FABRICATION

Today, wherever aluminum is used in the metalworking industry, a new trend is becoming increasingly apparent.

By using the fabrication facilities of supplier firms like Wolverine Tube, many aluminum manufacturers are reducing their production operations and releasing manpower, floor space and equipment for other duties. The net result is a definite saving in time and money plus a real boost in efficiency.

A prime example of Wolverine's fabrication ability is found in its refrigeration evaporator sub-assembly which is proving a real time-saver to busy refrigeration manufacturers. This prefabricated assembly is composed of a bunch-type aluminum coil, a one-piece accumulator (produced in one operation by Wolverine's exclusive Aluminum Spun End Process®) and two copper-to-aluminum connectors.

OTHER WOLVERINE ALUMINUM PRODUCTS

Famed for its Tubemanship, Wolverine Tube produces aluminum tube in a wide range of sizes and alloys in both drawn and extruded form. This rigidly quality controlled product is available in straight lengths, medium length coils and extra long coils.

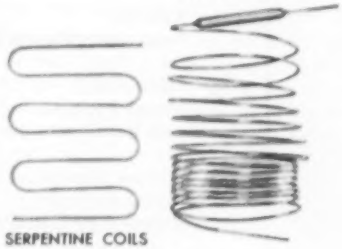
Still another of Wolverine's varied operations is the production of extruded aluminum shapes to customer specifications.

STRAIGHT LENGTHS

Also important is Wolverine's production of aluminum serpentine coils which give a maximum length of tube in small space. Other Wolverine fabrication facilities include finning, coiling, bending, flaring and expanding—to name but a few.

PROCESS PATENT APPLIED FOR

EVAPORATOR COIL



SERPENTINE COILS

DIVISIONS OF CALUMET & HECLA, INC.

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1461 CENTRAL AVENUE, DETROIT 9, MICH.
Manufacturers of Quality Controlled Tubing and Extruded Aluminum Shapes

Wolverine Trufin is available in Canada through the Unifin Tube Co., London, Ontario

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES.

EXPORT DEPT., 13 E. 40TH ST., NEW YORK 16, N. Y.

Now- Get Full Protection Engineered into 3-Phase Motors with a Single Built-in KLIXON Protector

Specify
and use motors with Built-in KLIXON PROTECTORS

- ★ **Eliminate Motor Burnouts**
- ★ **Reduce Production Down Time**
- ★ **Minimize Motor Repairs and Replacements**
- ★ **Assure Maximum Motor Capacity Under Any Conditions**
- ★ **Simplify Motor Controls**

For years motor manufacturers have looked to Klixon Protectors for the best inherent protection in single-phase motors. Now this same dependability can be built into your 3-phase motors — covering a horsepower range from fractional up through 7½ hp. (600 V.)

KLIXON Protectors Prevent Overheating Caused By:

1. Prolonged overloads
2. Single phasing
3. Stalling
4. Failure to start
5. Lack of ventilation
6. Increase in ambient temperatures
7. Plugging or reversing duty

Specify and use motors with Klixon Inherent Protectors. The additional cost is low . . . the savings high. Write for Bulletin MOPRI for details of inherent motor protection.

KLIXON®

METALS & CONTROLS CORPORATION
SPENCER THERMOSTAT DIVISION
3409 FOREST STREET, ATTLEBORO, MASSACHUSETTS

SPECIFY RECO

New Wake Forest College— Architects: Larson & Larson, Winston-Salem
Consulting Engineer: Louis Bouvier, Winston-Salem
Mechanical Contractors: Roe-Goodin-Jones Inc., Durham, N.C.; W. H. Sullivan Co., Greensboro, N.C.; J. T. Bates & Co., Winston-Salem.
Heating & Plumbing Distributors: Atlas Supply Co., Winston-Salem.

RECO . . . an old tradition at new Wake Forest College

When Wake Forest College recently made the big move to its new 19 million dollar campus, it took its traditions along. Among them: Hot Water by RECO.

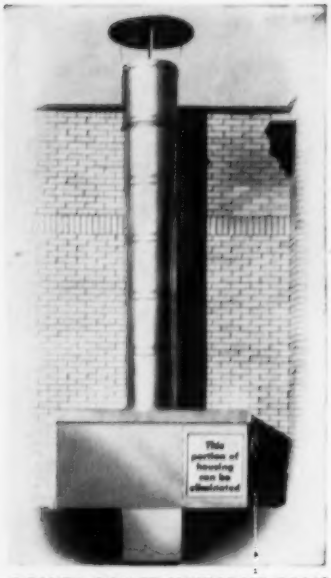
For years RECO Heat Exchange Equipment kept hot water flowing at the old campus in the little town of Wake Forest, North Carolina. On the new campus in Winston-Salem, N.C., six new RECO Copper Silicon Storage Heaters now keep hot water continuously on tap for students in five dormitories and the gym. These RECO units heat and store over 10,000 gallons per hour—providing rust-free hot water in temperatures ranging from 140° to 180°F.

But RECO Storage Heaters share honors at new Wake Forest with RECO Hot Water Converters and Expansion Tanks. Five installations of this RECO team were specified to guarantee years of trouble-free hot water service.

Top quality, competitive price and quick delivery are other RECO guarantees. That's why leading engineers, contractors and architects everywhere specify the full line of RECO Heat Exchange Equipment. On your next heating job—SPECIFY RECO.

For free catalogs and the name of the RECO representative nearest you, write RECO, Dept. I, 7th & Hospital Streets, Richmond 5, Va.

Richmond Engineering Co., Inc.



POWER DRAFT WITHOUT FANS OR MOTORS IN SMOKE LINE

POWER DRAFT

Makes the difference!

Quickdraft WITH 12-FT. VENT PIPE ELIMINATES 65-FT. CHIMNEY FOR

Bill's Commissary

North Canton, Ohio

Appearance, efficiency and economy . . . are the advantages Bill's Commissary gained by venting a gas fired steam boiler at roof level with a QUICKDRAFT commercial power draft unit. The unsightly appearance of a 65 ft. chimney towering above a one-story building, was eliminated. For safety and maximum efficiency, gas cannot be turned on in this 2,250,000 Btu boiler until after full draft has been established. In addition, Quickdraft was selected to overcome the 0.1 in. (1/10") negative pressure within the building that could be caused by exhaust fans over ovens and ranges, in event of failure of warm air fans in heat changer. These advantages, unobtainable by gravity draft, were most important on this installation. In addition, power draft venting cost $2,598.00 *LESS* than a 65 ft. chimney.

This installation is typical of the advantages Quickdraft offers for residential as well as commercial installations. A standard 22 in. Quickdraft unit was used . . . housing and pipe can be built by local sheet metal contractor. Write for complete details and engineering data.

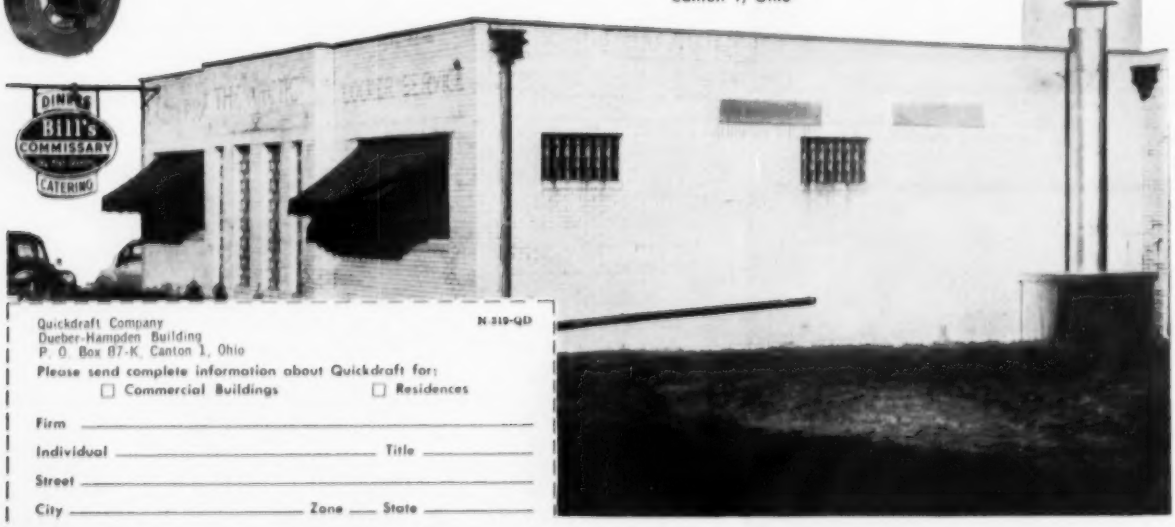
Commercial models for smoke outlet diameters 12, 14, 16, 18, 20, 22, 24 and 30 inches.

Residential models for smoke outlet diameters 4, 6,7, 8, 9 and 10 inches.

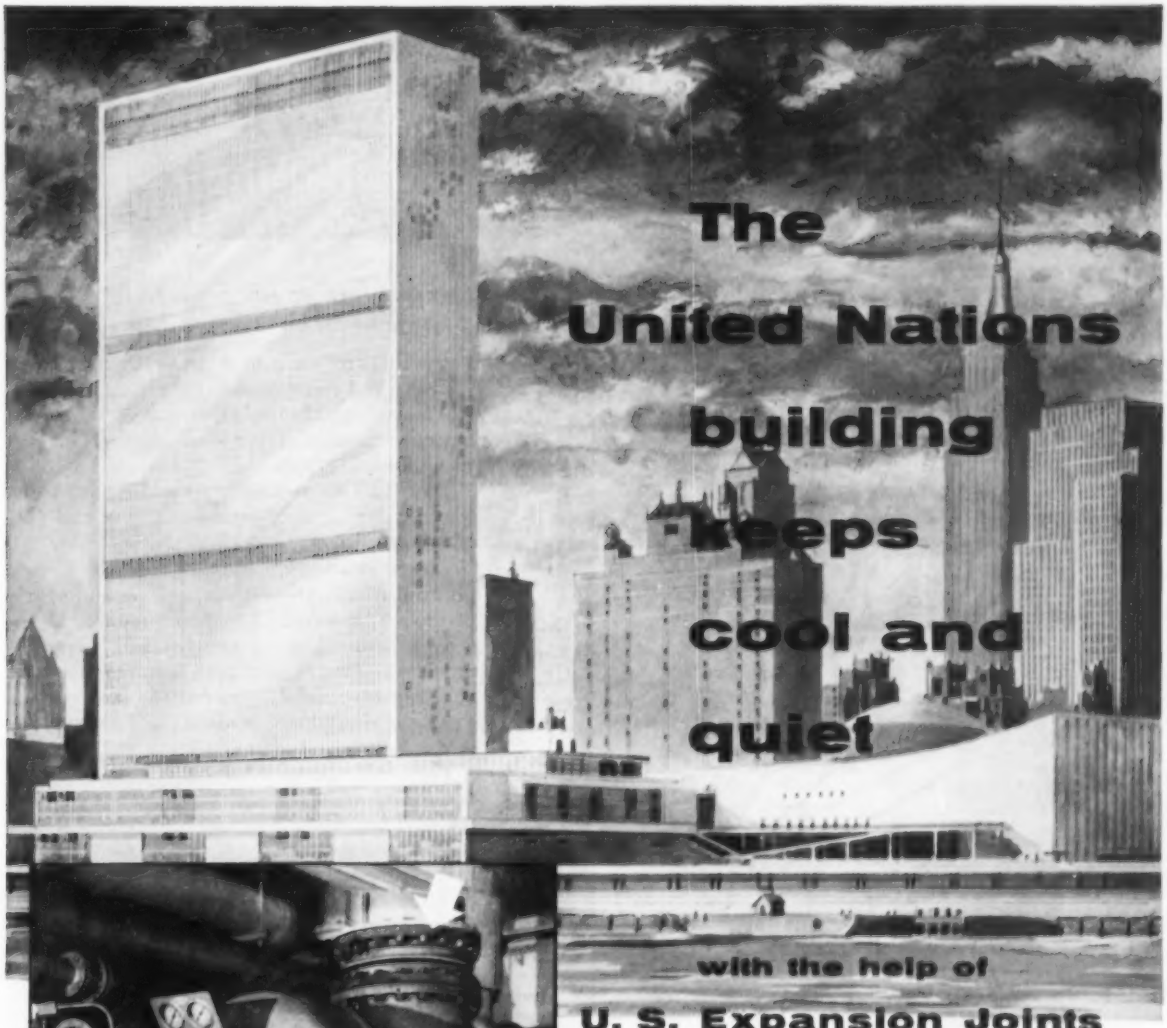
QUICKDRAFT HAS MANY USES

Venting commercial and residential heating plants . . . *exhausting* noxious and abrasive industrial fumes . . . *with or without a chimney!* Recommendations will be made without obligation upon receipt of rough sketch, notes on fuel used, unit input capacity, size of exhaust outlet, length, height and clear inside area of vent line.

Quickdraft
COMPANY
Dueber-Hampden Building
P. O. Box 37-K
Canton 1, Ohio



Quickdraft Company N-319-QD
Dueber-Hampden Building
P. O. Box 37-K, Canton 1, Ohio
Please send complete information about Quickdraft for:
☐ Commercial Buildings ☐ Residences
Firm _____
Individual _____ Title _____
Street _____
City _____ Zone ___ State _____



U. S. Expansion Joints

U. N. personnel remain cool and relaxed in their great edifice. The air-conditioning system is noiseless and vibration-free. Flexible rubber connections known as U. S. Expansion Joints "take up" any movement in the piping, effectively *hushing* and "calming down" vibration and pump noises in the system. In the photo, for example, you see one of the refrigerating compressors in the U. N. building. Note the U. S. Expansion Joints, one going out from the top of the turbine, the other from the side. U. S. Expansion Joints are also used for the chilled-water lines from the water chillers and the refrigerating lines from the refrigerating compressors; also on the water lines to and from the cooling towers.

A product of United States Rubber Company, these joints also offset stresses caused by expansion and contraction. Since they have no moving parts to wear or bind, U. S. Expansion Joints last a long time. Some are still in service after 30 years—a record unmatched by any other joint!

For any pipe line where noise and vibration are problems, contact any of the 28 "U. S." District Sales Offices or write U. S. Rubber, Mechanical Goods Div., Rockefeller Center, New York 20, N. Y.

UNITED STATES RUBBER COMPANY

US RUBBER

Mechanical Goods Division

United States Rubber

The thermostat on the wall–

puts comfort at his fingertips

IF HE wants to, the man at the desk can sit there all day and enjoy *complete comfort!*

If he prefers a change in temperature, the adjustment indicator is at eye-level—and within easy reach of his fingertips.

This is *deskside temperature control.* The key to the whole system is the thermostat on the wall—the Honeywell Round.

Thermostatic control is automatic—all year. There's no manual on-off operation with resulting cycle of too-hot, too-cool. No more tiresome, inconvenient adjustments of switches and valves. It provides uniform comfort both winter and summer.

Thermostatic control is sensitive. The thermostat is a precision instrument; it maintains a set temperature accurately.

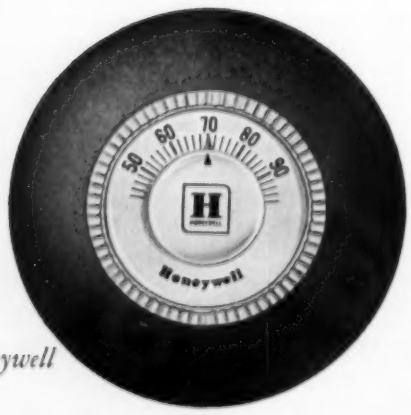
Thermostatic control is convenient. Unlike switch or valve types of heating control, the thermostat is always conveniently located. Changing a setting is easy and sure.

For complete information and help in selecting thermostatic controls for your clients, call your nearest Honeywell office.

For more details on the Honeywell Round, write Honeywell, Dept. HA-9-121, Minneapolis 8, Minn.

MINNEAPOLIS **Honeywell**

First in Controls

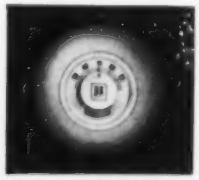


The Honeywell Round

The thermostat that was styled with modern architecture in mind

The popular Honeywell Round is the first truly *new* design in years. Made in pneumatic, electric, and electronic models for accurate, economical control of heating or cooling in hospitals, apartments, offices, schools, industrial buildings, hotels, motels and homes.

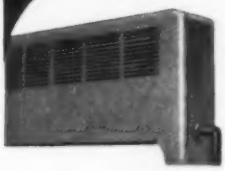
Practical! Ruggedly designed, yet it's precision-built for long service.



Easy to use! Setting and checking are simplified by one easy-to-read scale.

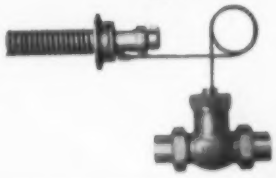
NO MATTER HOW IT'S HEATED

Control it the FULTON SYLPHON way



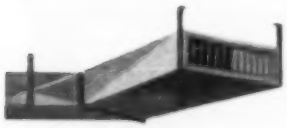
RADIATORS • CONVECTORS

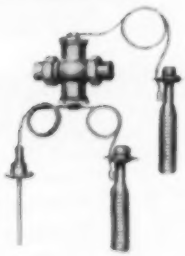
Automatic valves and regulators control steam or hot water radiators and convectors for individual room or zone control. Thermostatic valve shown is completely self-contained and self-powered. Other types are self-powered or electrically-operated, with adjustable dials or wall thermostats. For air temperatures up to 170° F.



UNIT HEATERS • VENTILATORS

Fulton Sylphon regulators are the low cost way to control space or air discharge temperatures using steam-coil equipped heaters, ventilators, or conditioners. Completely self-powered—no operating cost. Types for fresh or mixed air intakes, with or without "droop" compensating bulbs. Ranges up to 170° F.



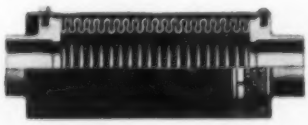


DUCT TYPE and PACKAGED CONDITIONERS

Central fan or split system, fresh air or mixed intake, Fulton Sylphon self-operated regulators modulate steam supply to keep space or air discharge temperatures at desired level. Types with adjustable thermostatic bulbs, wall thermostat, or both. With "weather" compensation, regulators can maintain or increase discharge temperature if supply temperatures fall.

ELECTRIC HEATERS • EQUIPMENT

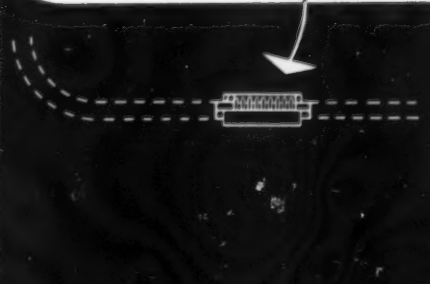
Operated on line voltage, 800 Series room thermostats regulate heating, cooling, or both with a sensitivity of ± ½° F. Can directly regulate electric cable or radiant panels, wall and unit heaters, portable heaters, and baseboard units. Can turn stokers, oil burners, fans, circulating pumps, or air conditioners on and off. Ranges to 85° F.



HEAT SUPPLY LINES

There's no need for loops or packing maintenance when Fulton Sylphon Packless Expansion Joints take up expansion in steam or hot water supply lines and finned convectors. Two-ply seamless Sylphon® Bellows solves leakage problems, permits expansion up to 1¼". Low-cost type shown takes pressures up to 40 psig, other types up to 100 psig.

SEND TODAY FOR CATALOG E-RH



Mr. Controls

Robertshaw-Fulton

CONTROLS COMPANY

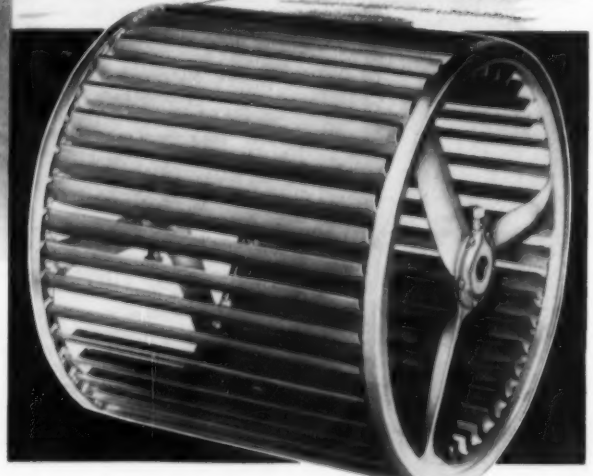
FULTON SYLPHON DIVISION • Knoxville 1, Tenn.

Heat-Well
Forced Air
Gas Furnace.

FOR

All types

OF WEATHER



Morrison Blower used in Heat-Well Furnaces.

In building America's First All-Assembled Welded Furnace, the Heat-Well Manufacturing Co. has taken great care to see that each assembly and individual part is finely engineered, with the objective of rendering the maximum reliability, long life, low owning cost and economical operation.

With this policy, plus the thorough flame, fan and limits control tests, it is little wonder that their forced air gas furnaces rank so high.

"FOR ALL TYPES OF WEATHER" — it has been Morrison's pleasure to work with original equipment manufacturers in building products for the distribution of conditioned air for the greatest comfort and well being.

MORRISON PRODUCTS INC.

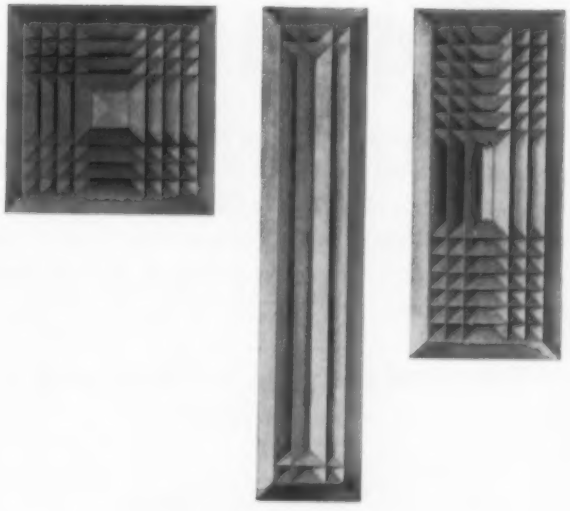
16816 WATERLOO RD.
CLEVELAND 10, OHIO

Just like people,
we come
in all shapes
and sizes.

ADP

ADP diffusers come in squares, rectangles and continuous units. Sizes and types to meet any requirement. Available with removable core and supply and return air combinations. Engineered for better air distribution.

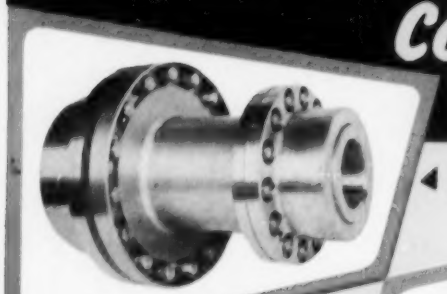
AIR DIFFUSION PLUS



AIR DISTRIBUTION PRODUCTS

116 South La Brea Avenue **Los Angeles 36, California**

Does your problem call for a *Specially Built Coupling?*



Specially designed Coupling for use in a wind tunnel

WALDRON Coupling hub with special plate provides required sliding motion

then put your problem up to

Waldron

The extensive engineering and manufacturing facilities maintained for the production of our popular standard type couplings put WALDRON in the most favorable position for handling special orders. WALDRON is the recognized source for prompt service on unusual coupling applications.

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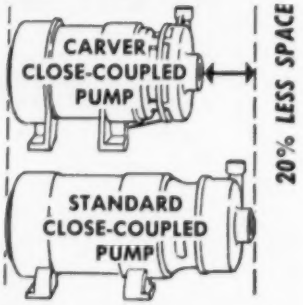
STANDARD TYPES — **Waldron COUPLINGS** — SPECIAL TYPES

NEW CARVER

MODEL B PUMPS

are really

CLOSE COUPLED



They Save as Much as 20% in Overall Length!

When we say close-coupled we really mean close-coupled. The illustrations dramatically tell the story.

Mounted on the sturdy, short shafts of close-coupled motors these highly efficient Carver Model B Pumps are stronger, quieter in operation, more attractive . . . better in every way for every job.

And extremely important, of course, is the extraordinary compactness which makes them ideal where space is limited.

GUARANTEED PERFORMANCE assures lasting satisfaction.

CARVER also manufactures Frame-Type Pumps, Split-Case Pumps, Submersible Sump Pumps and Self-Priming Pumps.

Ask for Bulletins

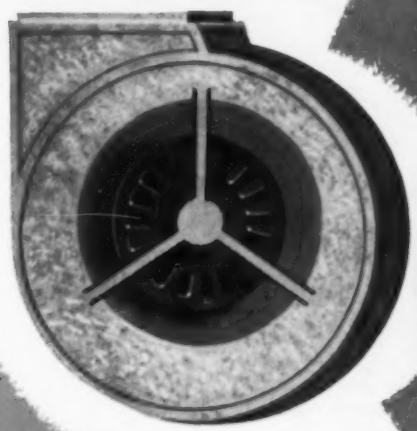
CARVER PUMP CO.
1460 Hershey Avenue
Muscatine, Iowa

CARVER

The quality name in pumps

any shape...any size... any kind of ductwork is better with galvanized steel... is best with

WEIRKOTE



In manufacturing ductwork, galvanized steel has long been relied on for ease and economy of fabrication . . . also providing maintenance-free long life.

But now, ever more fabricators are turning to Weirkote to do the job. Why? . . . Because Weirkote is the *superior* galvanized steel sheet, produced by the most modern continuous galvanizing process . . . quality-controlled from start to finish. It has the tightest of tight zinc coatings . . . resists cracking, peeling, flaking and, above all, corrosion as does no other metal for ductwork of proved durability. Weirkote is far stronger, more rigid, more heat-resistant. These are only a few of the reasons why we say: *In the long run, galvanized steel . . . in the LONGER run, WEIRKOTE.* Let Weirton show you why!

WEIRTON STEEL COMPANY
WEIRTON, WEST VIRGINIA
a division of
NATIONAL STEEL CORPORATION

WEIRTON STEEL COMPANY

78 JENKINS PRACTICAL PIPING LAYOUTS

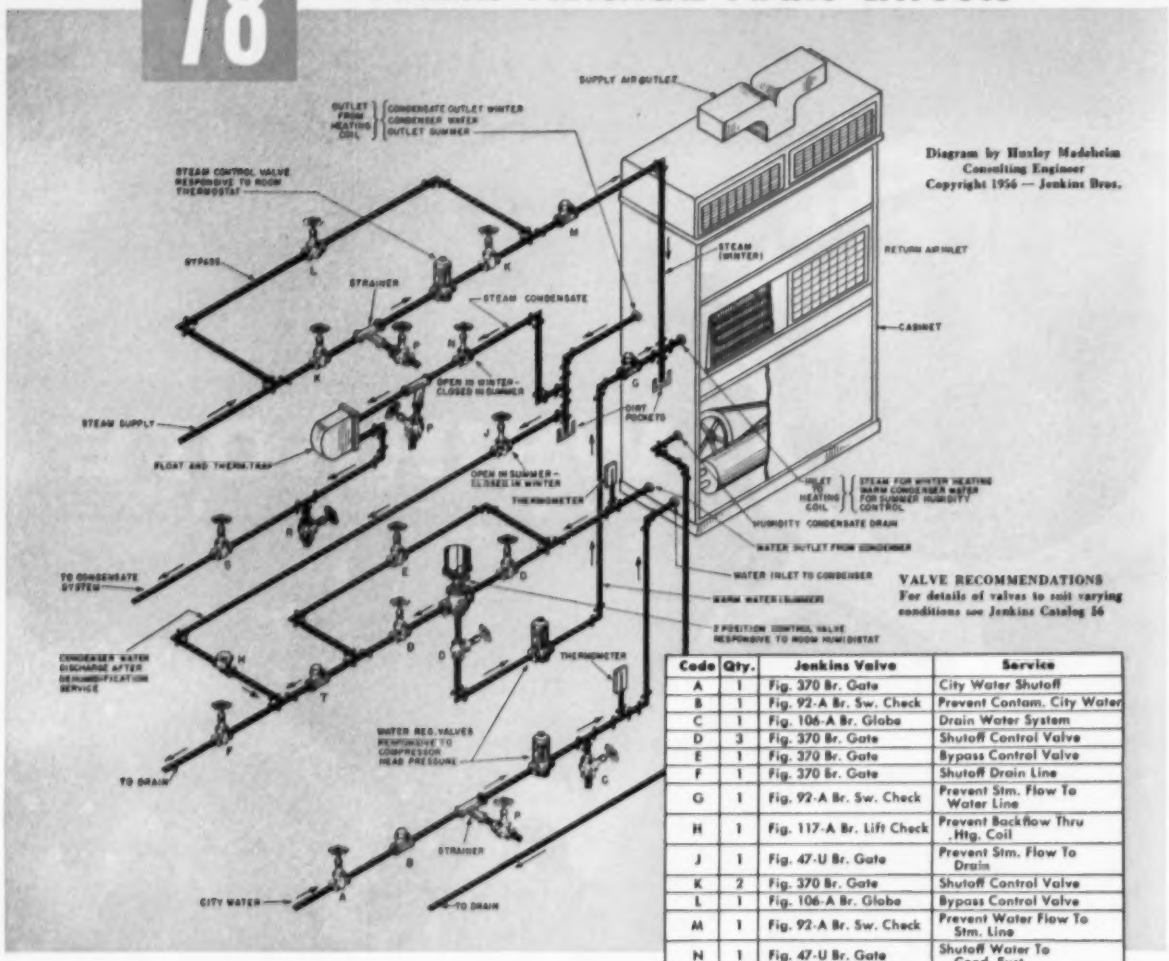


Diagram by Huxley Madeheim
Consulting Engineer
Copyright 1956 — Jenkins Bros.

VALVE RECOMMENDATIONS
For details of valves to suit varying conditions see Jenkins Catalog 56

Code	Qty.	Jenkins Valve	Service
A	1	Fig. 370 Br. Gate	City Water Shutoff
B	1	Fig. 92-A Br. Sw. Check	Prevent Contam. City Water
C	1	Fig. 106-A Br. Globe	Drain Water System
D	3	Fig. 370 Br. Gate	Shutoff Control Valve
E	1	Fig. 370 Br. Gate	Bypass Control Valve
F	1	Fig. 370 Br. Gate	Shutoff Drain Line
G	1	Fig. 92-A Br. Sw. Check	Prevent Stm. Flow To Water Line
H	1	Fig. 117-A Br. Lift Check	Prevent Backflow Thru Htg. Coil
J	1	Fig. 47-U Br. Gate	Prevent Stm. Flow To Drain
K	2	Fig. 370 Br. Gate	Shutoff Control Valve
L	1	Fig. 106-A Br. Globe	Bypass Control Valve
M	1	Fig. 92-A Br. Sw. Check	Prevent Water Flow To Stm. Line
N	1	Fig. 47-U Br. Gate	Shutoff Water To Cond. Syst.
P	4	Fig. 106-A Br. Globe	Strainer Blowoff
R	1	Fig. 106-A Br. Globe	Trap Test
S	1	Fig. 370 Br. Gate	Shutoff Condensate Flow

How to plan piping connections for an all-year

SELF-CONTAINED AIR CONDITIONING UNIT

A factory-built "package", the self-contained air conditioning unit shown in this layout is designed for both summer cooling and winter heating. In this particular system, it is assumed that steam is available for winter heating, and that the condenser is served by the city water supply. The condenser water discharge is used for the reheat necessary for humidity control.

The hookup for humidity control, particularly important for installations such as in night clubs, auditoriums, and others having a high moisture removal load, is shown in the diagram.

During the winter season, the heat output is regulated by a modulating steam valve which operates in response to a room thermostat. In the summer, another room thermostat starts the compressor when cooling is required, and the two-position water control valve, located as shown in the diagram, permits the water to flow to the drain.

When dehumidification is required without cooling, a room humidistat keeps the compressor in operation, but changes the position of the two-position water control valve so that the condenser discharge flows to the heating coil.

Two water-regulating valves are employed as illustrated. One, in the city water line, is set in the usual manner to maintain a predetermined head pressure on the compressor by varying the amount of water flowing into the condenser. The second, in the line from the condenser to the heating coil, is set for a head pressure higher than the pressure on the feed control valve.

This secondary condenser water control reduces cooling capacity and, at the same time, provides hotter water for reheat in the heating coil, thus serving to maintain proper relative humidity without excessive reduction of temperature. The amount of reheat obtained is approximately equal to the cooling provided by the unit, so that the net effect is that of dehumidification only, without cooling.

Consultation with accredited piping engineers and contractors is recommended when planning any piping system.

Enlarged diagram and full description of this layout free on request. Ask for Layout No. 78. Jenkins Bros., 100 Park Ave., New York 17.

JENKINS VALVES
LOOK FOR THE JENKINS DIAMOND
SINCE 1864
SOLD THROUGH PLUMBING-HEATING AND INDUSTRIAL DISTRIBUTORS

EQUIPMENT DEVELOPMENTS . . .

For reviews of Recent Trade Literature see Page 236

Air Blender . . .

. . .for high pressure-high velocity dual duct air conditioning systems. — *Minneapolis-Honeywell Regulator Co., Dept. HPAC,* 2753 *Fourth Ave., S., Minneapolis* 8.

Operating on principle new in commercial air conditioning, system has no wires or compressed air lines but operates pneumatically from pressure available in air it is controlling. Cited features include: constant volume of air to each room, even with wide variations in central system conditions; air balancing by dialing without use of gages, even before fan is running; long life due to no mechanical linkages. Heart of blender unit is pair of valves in which balloon-like neoprene diaphragms (only moving parts) control amount of cold air or hot air. Total cfm of air is preset according to load requirements. When specially-designed pneumatic thermostat calls for cooling, flow regulator on hot duct valve reduces amount of heated air, reducing total flow and changing total pressure. Change is detected by flow regulator on cold valve, which admits additional cold air to maintain preset total air flow. Can be used with ceiling, side wall, or under window air outlets.

Room Air Conditioner . . .

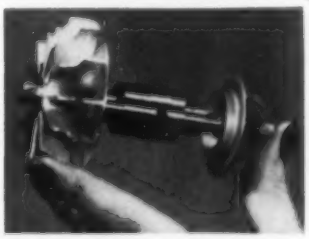
. . .with fan and coil design — *Worthington Corp., Dept. HPAC, Harrison, N. J.*

For year 'round air conditioning of hotels, office buildings, hospitals, schools, other multistory buildings. Recessed or cabinet type units engineered to supply heating, cooling, air filtration, ventilation. Connected to supply and return water piping system emanating from remotely located central system.

Power Roof Exhauster . . .

. . .of all aluminum construction — *Airoflo Engineering Co., Dept. HPAC,* 4520 *Aviation Dr., Los Angeles* 39.

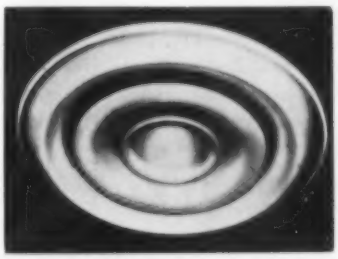
In direct driven, belt driven models. Designed to be weatherproof, corrosion resistant, quiet operating, low in height. Cited features are resilient mounted motors, low inlet and outlet velocities, dynamically balanced blower wheels. In six sizes, 23 capacity ratings 150 to 3000 cfm. For commercial, industrial exhaust.



Refrigeration Unit . . .

. . .for use in aircraft air conditioning systems—*Carrier Corp., Dept. HPAC, Syracuse* 1, *N.Y.*

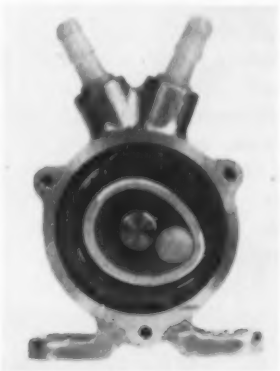
Entire compressor weighs 8 lb, is 100 times more powerful than cooling unit in household refrigerator, says company. "Mighty mite" designed to remove heat added by speed of airplane during high altitude flight, interior heat generated by passengers, crew, electronic control apparatus, galley, sun's rays.



Ceiling Diffuser . . .

. . .engineered to be adjustable on the job, economical — *Titus Mfg. Corp., Dept. HPAC, Waterloo, Iowa.*

Model "T-1" is new three-cone unit added to company's line. Features curved contour cone construction. Designed for easy installation. For exposed duct or flush mounting. Adjusts to two different air patterns by changing screws on inner cone assembly. Available in standard sizes, with accessories.



Pumps . . .

. . .for small capacity pumping applications — *Becher Pump Co., Dept. HPAC,* 852 *Belmont Ave., Chicago* 14.

Designed for long, trouble-free pumping service on wide range of chemicals. With corrosion resistant aluminum body and end cover, oil impregnated bronze bearings, vinyl tubing to convey material being pumped.

Air Conditioner . . .

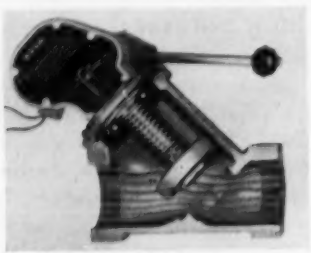
. . .for year 'round service in schoolrooms in northern, central parts of

EQUIPMENT DEVELOPMENTS

Continued

U. S. — *American Air Filter Co., Inc., Dept. HPAC, Louisville 8.*

"HerNel-Cool" unit developed to fill demands resulting from increased school enrollments, rapid growth of year 'round school programs. Operates like unit ventilator during winter, early spring, late fall. When outdoor temperatures rise above desired comfort level, chilled water is introduced into unit.



Shutoff Solenoid Valve . . .

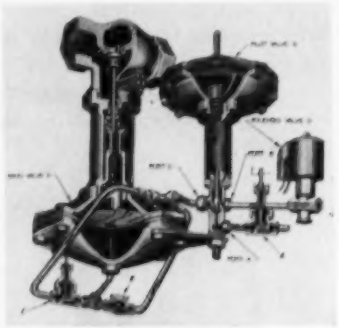
. . . for gas supply lines leading to boilers, furnaces, ovens, other heating equipment to shut off fuel upon power failure — *Automatic Switch Co., Dept. HPAC,* 391 *Lakeside Ave., Orange, N. J.*

"Bulletin 8022" model in ¼ to 3 in. sizes. Designed to control flow of manufactured, natural, LP gases in maximum ambient of 104 F. Features, "toggle action" release mechanism. Larger sizes available to handle various grades of fuel oil, noncorrosive liquids, gases.

Dust Collector . . .

. . . designed for high gas flow — *Research-Cottrell, Inc., Dept. HPAC, Bound Brook, N. J.*

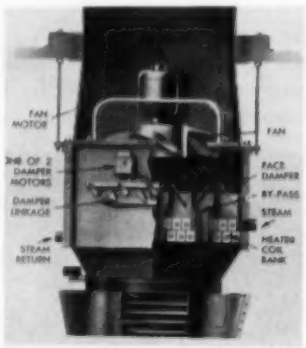
"Cyclo-trell" multiple tube unit has aerodynamic vane design engineered to produce higher velocities in inlet tubes, increase gas flow in outlet tubes.



Heat Control . . .

. . . featuring adjustable slow opening, fast and positive steam flow dead-end — *C. E. Squires Co., Dept. HPAC,* 18502 *Syracuse Ave., Cleveland* 10.

"Valvatrol" permits piping system to warm up in unison, thus eliminating operating noise, says company. Also, is said to effect steam saving, high comfort standards by preventing temperature override. Connected to existing thermostatic controls by "door bell" type hookup.



Unit Heater . . .

. . . designed for replacement of air exhausted in manufacturing processes and for comfort of workers —*L. J. Wing Mfg. Co., Dept. HPAC, Linden, N. J.*

Consists of motor and fan, heater section comprising alternate heating and bypass passages, distributing outlet. Air brought in through heating passages passes over extended surface steam coils. Air brought in through bypasses is not heated. In vertical, horizontal flow types.

Condenser Tube . . .

. . . in two new types — *Wolverine Tube, Div. of Calumet & Hecla, Inc., Dept. HPAC, Guardian Bldg., Detroit* 26.

"Trufin Type I/L" has fins on both outside, inside diameters. All-aluminum tube designed to bring increased heat transfer efficiency to areas where air cooling is necessity. Other type, "Trufin Type L/C," also for air cooled unit applications, is bimetal. Composed of "high-finned" aluminum exterior tube mechanically bonded to inner liner of corrosion resistant copper.

Blower . . .

. . . with "inside out" motor in which normally stationary elements of conventional motors become rotor to which blower wheel is assembled and rotates around fixed shaft and field assembly — *Morrison Products, Inc., Dept. HPAC,* 16816 *Waterloo Rd., Cleveland* 10.

"Intra-Drive" unit dynamically balanced after assembly for quiet operation, minimum vibration, says company. Central location of motor in wheel is said to allow more uniform air distribution through outlet. Capacities range 500 to 1500 cfm at static pressures 0.5 to 1.25 in. WG.

200 Hp Boiler . . .

. . . with self contained design added to company's line — *Cleaver-Brooks Co., Dept. HPAC,* 326 *E. Keefe Ave., Milwaukee* 12.

Incorporates latest combustion, safety devices, says company. Offered in five series for light oil, No. 2 oil and gas, No. 6 oil and gas, No. 6 oil, straight gas. Cited features include full modulating burner, silent oil pump, davited rear and front door which expedite tube removal and

WOOD WON'T ROT WHEN IT'S COLD AND DRY

Living fungi, which break down the substance of wood are microscopic and abundant. But they need WARMTH and DAMPNESS to develop. Dampness will also peel off paint, crumble plaster, cause iron and steel to rust.

Vapor can flow through asphalt, paper, plaster and most building materials. It condenses when, upon striking a colder surface, the air in which it is suspended reaches a dew-point.

An empty air space is a good insulator against heat flow by Conduction because of its low density. But air does not prevent heat flow by Radiation and Convection. Of all heat transferred through structural spaces, about 50% to 93% is by Radiation, depending on direction of heat flow. All but about 7% of the rest is Convection. The surfaces of scientific multiple aluminum have a high 97% reflectivity for heat rays; a low 3% absorptivity and emissivity. Its layers of aluminum drastically retard Convection. Conduction is slight through its preponderant low density air spaces.

Scientific multiple aluminum insulation* is long and continuous and almost completely impervious to water vapor. Vapor infiltration under its flat, stapled flanges is slight.

Where multiple aluminum is used, fortuitous vapor and water (for instance rain) which intrude into wall and similar spaces, will gradually flow out as vapor through exterior walls and roofs as vapor pressure develops within; because vapor flows from areas of greater to less density. The vapor cannot back up through the almost impervious aluminum, so it flows out, because exterior walls and roofs have substantial permeability in comparison to aluminum, far greater than the required 5 to 1 ratio.

*U. S. Pat. Nos. 2,750,313; 2,314,757; 2,227,385; 2,196,006; 2,101,836.

To obtain maximum uniform depth protection against heat loss and condensation formation, it is necessary to use **edge-to-edge** multiple aluminum, **each** layer of which stretches from joist to joist.

The U. S. National Bureau of Standards brochure: "Moisture Condensation in Building Walls," discusses vapor and heat flow, and the causes and prevention of condensation. Use the coupon. Get a copy at our expense.

INFRA INSULATIONS CAN BE PURCHASED everywhere through your preferred local dealer for 3¢ to 12¢ per sq. ft. depending on the type.

Infra Insulation, Inc., 525 Bway., N. Y. C. Dept H-9
Send "Moisture Condensation in Building Walls."

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Firm_____

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EQUIPMENT DEVELOPMENTS

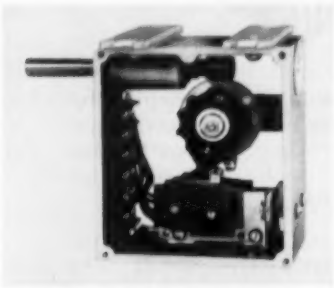
Continued

cleaning. Is said to have very quiet operation.

Water Mixer . . .

. . . engineered to shut itself off in case of thermostatic motor failure — *Powers Regulator Co., Dept. HPAC, 3434 Oakton St., Skokie, Ill.*

"Type N Hydroguard" will also shut off required port in case of hot or cold water supply failure, says company. Cited features include rotating inlets and outlet, which turn in 90 deg steps so unit can be installed in any position. Temperature settings in 65 to 115 F or 85 to 160 F ranges controlled by concealed adjustment.

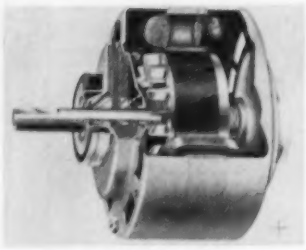


Rotating Limit Switch . . .

. . . with heavy duty pilot ratings to 480 volts—*Furnas Electric Co., Dept. HPAC, 1000 McKee St., Batavia, Ill.*

Unit incorporates two single pole, double throw, snap action contact assemblies.

Features include: general purpose cast aluminum housing with removable cover plate on each side of switch; "Oil-Lite" bearings on input shaft plus heavy duty worm, cam gears, says company.



Fractional Hp Motors . . .

. . . in new shaded pole and permanent split capacitor models — *Westinghouse Electric Corp., Dept. HPAC, Box 2278, Pittsburgh 30.*

Recommended by company for application to room air conditioners, unit heaters and coolers. Cited feature is new bearing and lubrication system. Shaded pole unit rated 1/30 to 1/8 hp on 115 or 230 volts, 60 cycles, at 1050 rpm. Permanent split capacitor model rated 1/30 to 1/4 hp on 115 or 230 volts, 60 cycles, at 1075 rpm. Reversible motors available.

Sprayable Coating . . .

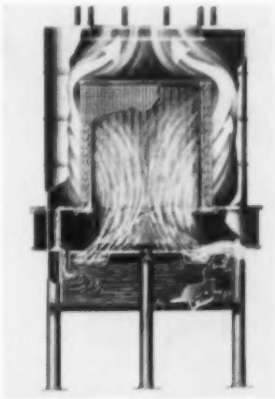
. . . formulated to give "sheet" protection to tanks, ducts, other large equipment — *Electroplating and Coatings Div., Metal & Thermit Corp., Dept. HPAC, Rahway, N. J.*

Is said to provide film thickness of 50 to 60 mils per spray coat. Based on vinyl resins, "Unichrome Super 5300" resists corrosive action of strong acids, concentrated caustic and salt solutions, other corrosive solutions, says company.

Thermostat . . .

. . . for hotels, motels, other buildings requiring individual room temperature control during occupancy periods, with manual setback to conserve fuel during vacancy — *Minneapolis-Honeywell Regulator Co., Dept. HPAC, 2641 Fourth Ave., S., Minneapolis 8.*

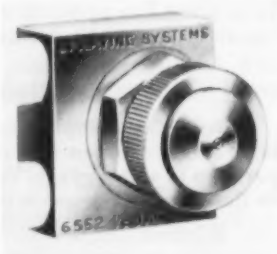
Low-voltage unit combines two thermostats and manually operated "hi-lo" changeover switch into single instrument. High setting adjustable between 67 and 75 F. Can be used to control either electric radiator valves in individual room temperature installations or to monitor motors on zone valves.



Oil Bath Air Filter . . .

. . . designed for high efficiency, low pressure loss — *Air-Maze Corp., Dept. HPAC, 25000 Miles Rd., Cleveland 28.*

"LPD" achieves low pressure drop operation without moving parts, outside energy supply, says company. Is said to make economical oil bath filtration available for use with broader range of compressors, blowers, engines. In four models with capacities ranging 800 to 24,000 cfm.



Nozzle . . .

. . . for pneumatic atomizing applications where space is at premium — *Spraying Systems Co., Dept. HPAC, 3219 Randolph St., Bellwood, Ill.*

Small sized unit available in range of capacities in choice of round, wide angle round, flat sprays. Made in brass or stainless steel.

(Continued on page 190)

THIS HAND BEATS ALMOST ANY AIR OR FUME EXHAUST PROBLEM

Beat noise . . . with the DeBothezat *Centrifugal* Roof Ventilator. Runs at low tip speeds, moves large volumes of air efficiently against static pressure. Low in silhouette, blends well with modern architecture.

Beat oil and dust-laden air . . . with the *Vertical Discharge* Roof Ventilator. Exhausts air straight up at high velocity. Keeps harmful residue from attacking the roof.

Beat most industrial air removal problems . . . with the *Power-Flow* Roof Ventilator. Ruggedly built unit in an aerodynamically correct, weather-proof housing.

Beat hot, flammable, corrosive fumes . . . with the *Bifurcator*®. Fumes bypass the motor (located in an isolated chamber) which always stays clean, cool and accessible.

Send for bulletins on DeBothezat fans for your problems.

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Please send me a complete catalog on each of the following DeBothezat fans:

- ☐ Centrifugal Roof Ventilator
- ☐ Vertical Discharge Roof Ventilator
- ☐ Power-Flow Roof Ventilator
- ☐ Bifurcator

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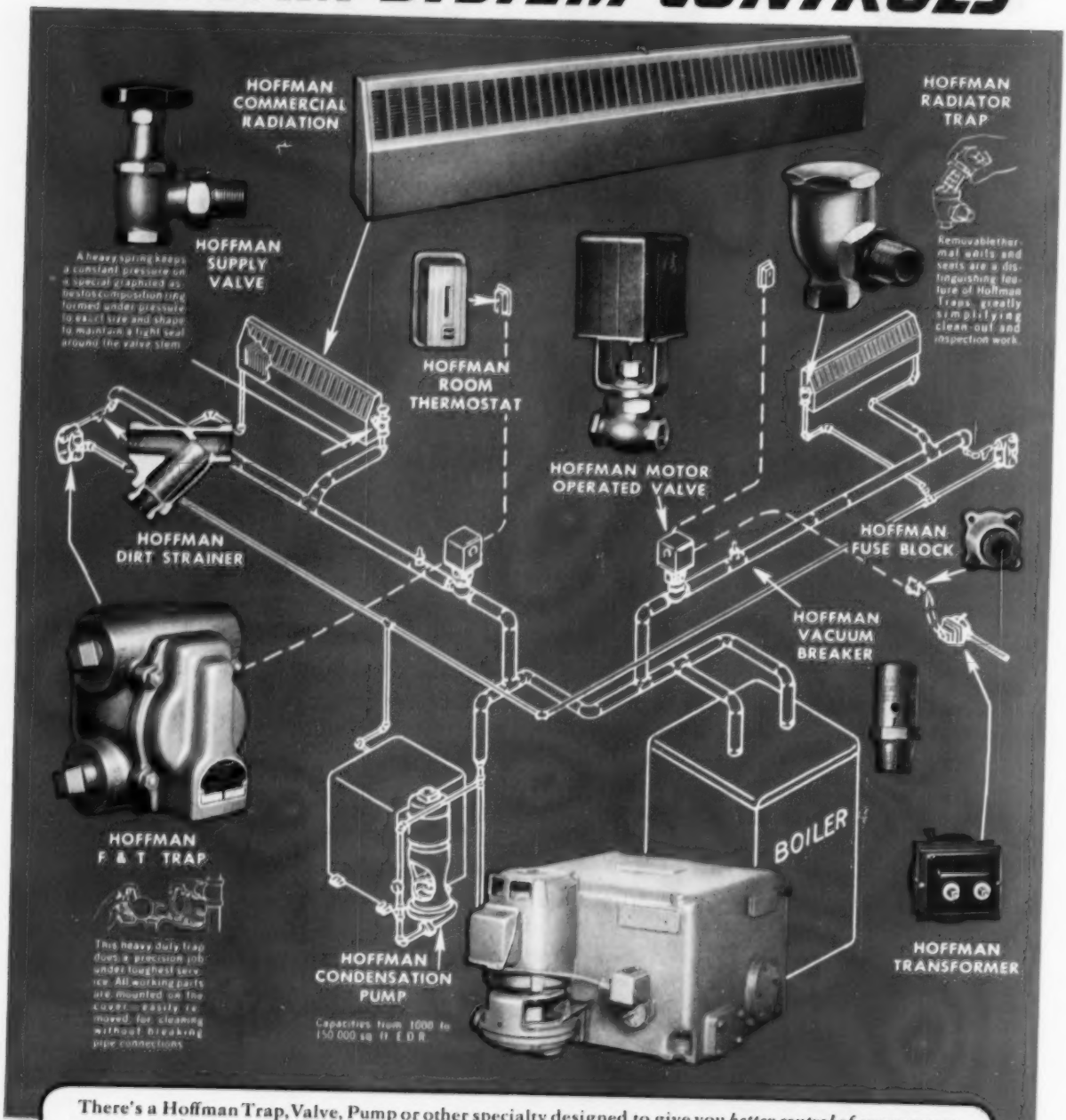
HOFFMAN COMPLETE LINE OF STEAM SYSTEM CONTROLS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HOFFMAN RADIATOR TRAP
A heavy spring keeps a constant pressure on a special graphited asbestos composition ring formed under pressure to exact size and shape to maintain a tight seal around the valve stem
HOFFMAN SUPPLY VALVE
Removable thermal units and seats are a distinguishing feature of Hoffman Traps, greatly simplifying clean-out and inspection work.
HOFFMAN ROOM THERMOSTAT
HOFFMAN MOTOR OPERATED VALVE
HOFFMAN DIRT STRAINER
HOFFMAN FUSE BLOCK
HOFFMAN VACUUM BREAKER
HOFFMAN F & T TRAP
This heavy duty trap does a precision job under toughest service. All working parts are mounted on the cover—easily removed for cleaning without breaking pipe connections
BOILER
HOFFMAN CONDENSATION PUMP
Capacities from 1000 to 150 000 sq ft E D R
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There's a Hoffman Trap, Valve, Pump or other specialty designed to give you *better control* of every steam system requirement. And, *each* Hoffman product is distinguished by exclusive features that assure customer satisfaction, long, care-free service. *It's the* COMPLETE, *tested, quality line* backed by a dependable, single source of supply and responsibility. *Yet Hoffman Products cost no more than the ordinary kind—and pay their way with the fuel they save.* To avoid delays—order now from your wholesaler of heating and plumbing supplies. Catalogs available on all items.

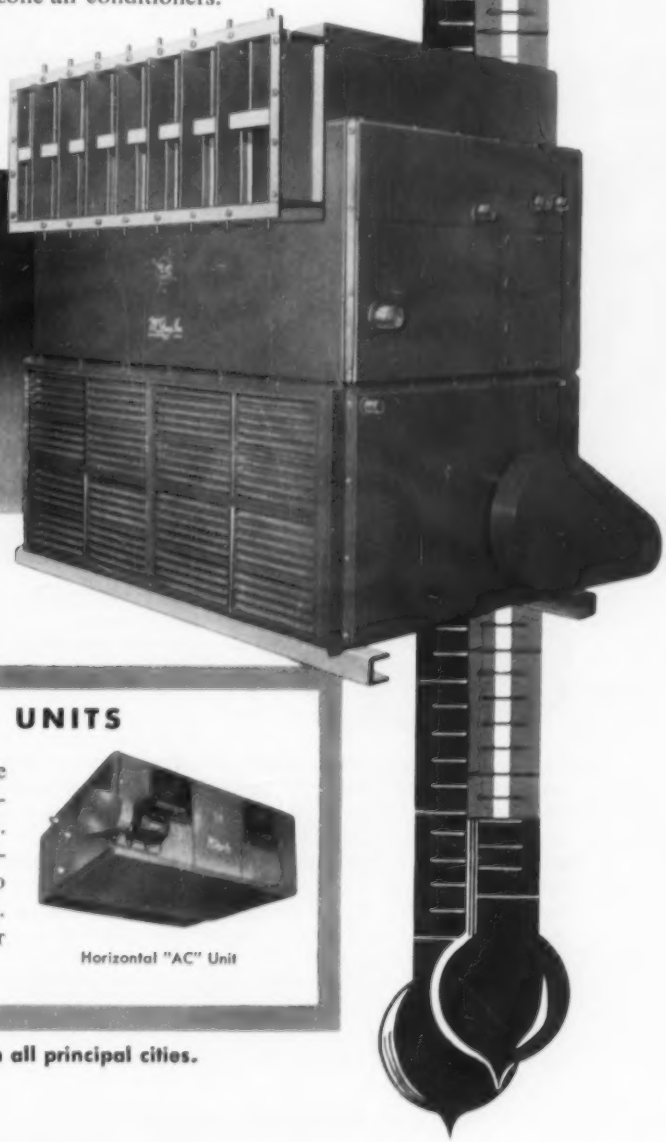
HOFFMAN SPECIALTY MFG. CORP. • 1700 West 10th Street, Indianapolis 7, Indiana

Makers of Valves, Traps, Hot Water Heating Systems, Vacuum and Condensation Pumps...Sold by Leading Wholesalers of Heating and Plumbing Equipment

COOLING • HEATING • VENTILATING • HUMIDIFYING • DEHUMIDIFYING • FILTERING • ZONE CONTROL • The McQuay Multi-Zone Air Conditioning Unit is designed for buildings where both heating and cooling are required at the same time. The unit is constructed to deliver to each zone, either filtered, cooled and dehumidified air; or filtered, heated and humidified air. By automatic control of the zone dampers a mixture of the cold and warm air is supplied to each zone at the required air temperature. Available in eight sizes in horizontal or vertical models with capacities from 1360 CFM to 21000 CFM. Each "MC" unit has a maximum number of zones—from six on the smallest size to 22 on the largest. A complete line of coils and accessories are available. Write for McQuay's new 12 page catalog, No. 550. It will give you a big assist in planning the installation of multi-zone air conditioners.

McQUAY "MC"

HEATS AND OR COOLS



SIMULTANEOUSLY
up to 22 zones from one Multi-Zone Unit

McQUAY "AC" UNITS

Popular McQuay "AC" units, companions to the "MC" Units, provide heating, or cooling to commercial buildings where only one zone is required. Fourteen models for horizontal or vertical installation offer capacities ranging from 640 CFM to 21000 CFM. Write today for McQuay Catalog No. 505 to help you meet specifications for central air conditioner installations.

Horizontal "AC" Unit

McQuay representatives located in all principal cities.

McQuay Inc. 1600 Broadway N. E., Minneapolis 13, Minn.

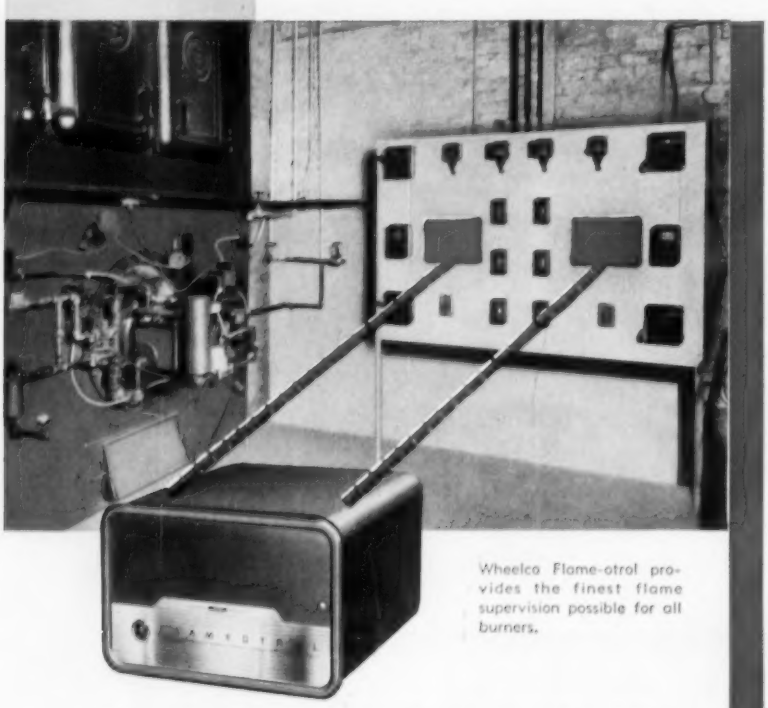
HEATING • AIR CONDITIONING • REFRIGERATION

THE MARK OF QUALITY

BARBER COLMAN

Wheelco Instruments

Here's Positive Protection Against Flame Failure— Specify Flame-otrol for Any Type Burner!



Wheelco Flame-otrol provides the finest flame supervision possible for all burners.

Wheelco Flame-otrol combustion safeguard systems offer unfailing, positive protection for any burner—gas, oil, or combination gas-oil.

One basic type, the Series 1470 Conductivity-Rectification system, uses the ability of a flame to conduct current to protect manually or semi-automatically ignited gas, oil, or combination fuel burners.

Series 1570 Infrared System, the other basic type, depends on the fluctuating current of a flame frequency for relay response. All Wheelco Flame-otrols offer the advantages of compact plug-in design, standard electronic tubes, heavy-duty construction, and other advanced features.

Your Wheelco field engineer can help you select the right flame supervision system, choosing from a full line of instruments and accessories. Call him today.

WHEELCO INSTRUMENTS DIVISION

Barber-Colman Company

DEPT. I, 1501 ROCK STREET, ROCKFORD, ILLINOIS
BARBER-COLMAN OF CANADA, LTD., Dept. E, Toronto and Montreal, Canada

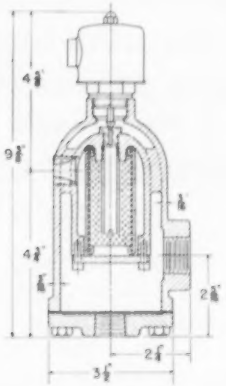
EQUIPMENT DEVELOPMENTS

Continued from page 186

Exhaust Silencer . . .

. . . designed for use where "extra" quiet operation is desired on cabinet type dust collectors — *Torit Mfg. Co., Dept. HPAC, 287 Walnut St., St. Paul 2.*

Available in five models to fit exhaust openings on "50, 60, 70, 80 series" and "Model 122" collectors. Units rectangular in cross-section, interlined with 1 in. closed cellular vinyl foam, said to absorb 80 percent of noise without restricting air flow.



Steam Humidifier . . .

. . . for use in steam heated offices, conference rooms, apartments, other small room areas — *Armstrong Machine Works, Dept. HPAC, Three Rivers, Mich.*

"Model VC-1" designed to maintain relative humidity at desirable level. Connects directly to steam radiators, piping. Controlled by humidistat. Except for dead-end service, condensate formed in unit drains back through supply line and no drain trap is needed, says company.

ASPHALT

is the difference

IN

PRE-SEALED **DURANT** INSULATED PIPE

When D.I.P. goes underground, its integral layer of asphalt becomes the guardian of your installation.

Among all pre-sealed insulated conduit, only D.I.P. with asphalt has complete and permanent waterproofing . . . only D.I.P. with asphalt has total defense to corrosion. This exclusive safeguard is the reason why D.I.P. pipe and insulation retain their original efficiency after years underground, even after decades!

This tough, non-porous, high-melting-point barrier is the important difference in insulated underground piping. ***It is your guarantee that you will have less maintenance cost tomorrow, if you specify D.I.P. today.***

Original cost is low, too! D.I.P. is shipped in standard pre-fabricated increments . . . ready for simple position-welding and rapid field-jointing.

GET THE FULL D.I.P. STORY. OUR 54-PAGE CATALOG #35 IS AVAILABLE ON REQUEST, WITHOUT OBLIGATION OF COURSE. WRITE FOR IT TODAY.

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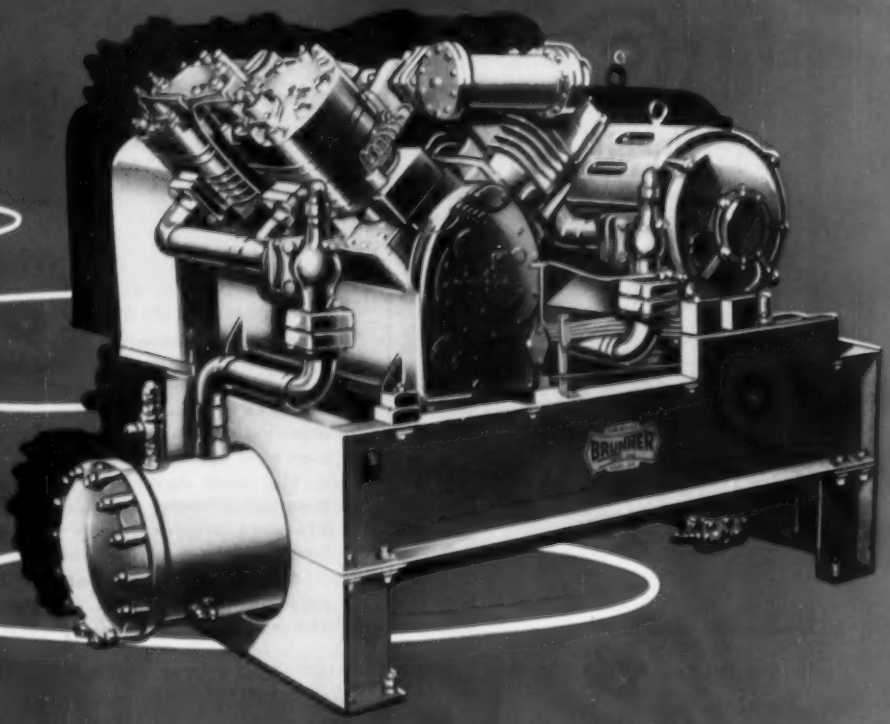
STAFF ENGINEERS AND REPRESENTATIVES IN PRINCIPAL CITIES AND IN CANADA ARE AT YOUR SERVICE.

1906

Engineered for entertainment, the stereoscope . . . popular in 1906 . . . was the forerunner of modern 3-D photography. It was in 1906 that the first *Brunner-engineered* product was built.

TODAY **Brunner engineering offers the most complete line of Air Conditioning Condensing Units available from a single source.**



Whether the job be large or small, there's a *right* Brunner Condensing Unit for every remote Air Conditioning application. Complete size range from ¼ H.P. through 100 H.P. Self-contained BAC units in 3, 5, 7½ and 10 H.P. models.

ALSO AVAILABLE

AIR-COOLED CONDENSING UNIT FOR OUTDOOR INSTALLATION
—in 2-, 3- and 5-ton capacities, with protective shelter.

PROVEN QUALITY
50th Anniversary
BRUNNER
SINCE 1906
DEPENDABLE

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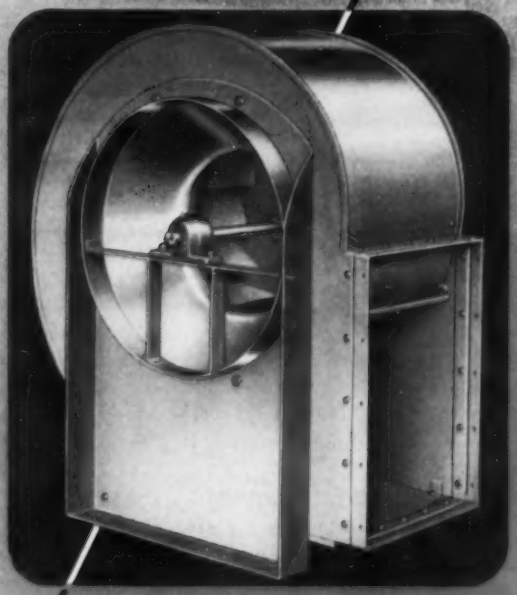
ALADDIN FANS



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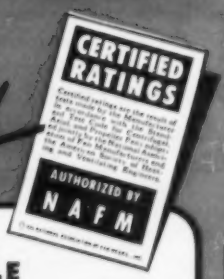

- RUGGED
- DEPENDABLE
- CERTIFIED RATINGS

You will find that ALADDIN Fans are available in many types . . . each ruggedly built and fully equal to the job for which it is intended. Thousands of ALADDIN Fans are now in service meeting the air-handling requirements of every essential industry, from chemical to aircraft, on farms and aboard ships.

More and more architects and engineers have come to know ALADDIN Fans . . . and to recognize their merits of quality and dependability.

Write for complete data

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REPRESENTATIVES IN ALL PRINCIPAL CITIES IN THE WEST

EQUIPMENT DEVELOPMENTS

Continued

Cooling Towers . . .

. . . line expanded to include 25, 30, 40, 50 ton models —*Larkin Coils, Inc., Dept. HPAC,* 519 *Memorial Dr., S. E., Atlanta* 1.

Designed for outdoor or indoor use. "Water Saver" units have wetted surfaces of all-heart redwood, with interlocked construction. Bolted panels designed to permit easy dismantling in field.

Abrasive Cutting Machine . . .

. . . available in "Hi-Boy" model—*Beaver Pipe Tools, Inc., Dept. HPAC, Warren, Ohio.*

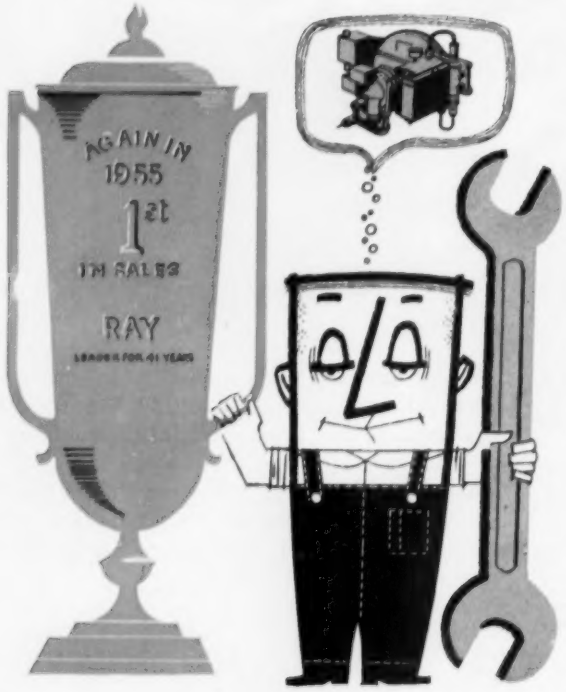
Units designed to cut pipe to 12 in. Accomplished by raising entire cutting head, including motor mount, motor, wheel guard, etc., with solid lift block, says company. Longer vise chain furnished to accommodate the larger material. Unit also cuts 6 in. shapes, 2½ in. solid stock. Can be furnished with either 7½ or 10 hp, 220/440 volt, three phase, 60 cycle motor.

Gas Conversion Burners . . .

. . . in four types, engineered for installation on "almost any type of furnace"—*Northwest Foundry & Furnace Co., Dept. HPAC, Portland, Ore.*

Types include two models with different lengths of blast tubes, which are directed horizontally into firebox; one model with upshot type of burner; and "FGD" series, which is classified as power burner for installations requiring to 28 million Btu per hr.

Only RAY gives you both!



A quality burner *plus* local service

Again in 1955, as for the past 41 years, Ray was the leader in rotary burner sales. This leadership is positive proof that Ray rotary oil, gas or combination gas-oil burners are the first choice of the heating industry.

When you know Ray products and have experienced Ray service, you will then see why Ray continues to be the leader. On-the-spot local burner service eliminates costly shutdowns. Your local, factory-trained Ray dealer knows his product, knows how to service it quickly and economically. Further, he is backed by Ray factory engineers on any complex problems.

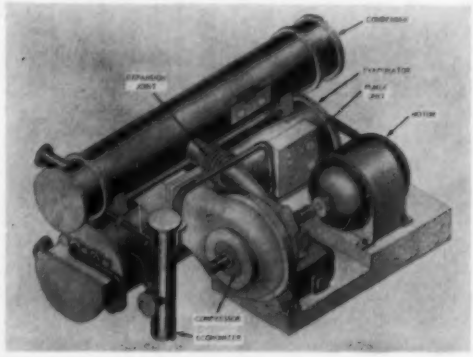
Your local Ray dealer will be glad to discuss details of your present or planned installation. Ray dealers are listed in the yellow pages of your telephone directory under Oil Burners—or, write us for the name of your Ray dealer.

RAY OIL BURNER COMPANY
1301 San Jose Ave., San Francisco 12, California
629 Grove Street, Jersey City, New Jersey

3794

EQUIPMENT DEVELOPMENTS

Continued



Centrifugal Compressors . . .

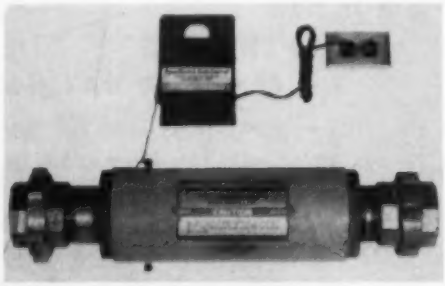
. . . in capacities 200 to 2000 tons—*Surface Combustion Corp., Dept. HPAC, Toledo* 1.

Are overhung types with two stages, balanced back-to-back impellers and diffusers. Automatically controlled adjustable inlet guide vanes designed to provide optimum stability, efficiency at all loads. Use of guide vanes permits constant speed operation with squirrel cage induction or synchronous motor with power input through control, says company.

Air Cooled Equipment . . .

. . . for small commercial air conditioning, refrigeration applications—*Frigidaire Div., General Motors Corp., Dept. HPAC, Dayton* 1.

Air cooled condensers offered in 2, 3, 5 ton sizes. For use in conjunction with self contained air conditioning equipment or commercial refrigeration products where is desirable to provide air cooled operation. Complete condensing units also available in same sizes. Are same as condensers except for addition of compressor. Designed for outside installation.



Electric Scale Control Units . . .

. . . available in 3, 4 in. sizes for treating large volumes of water—*Aqua Electric Scale Control, Inc., Dept. HPAC, 2026 E. 22nd St., Cleveland* 15.

Designed for prevention of hard scale formation. Units will treat to 300 and 450 gpm, respectively, says company. Controls housed in plastic case. Cylinders are heavy wall plastic tubing with screwed end bushings for pipe connections. Smaller units previously available in sizes ¾ to 2 in.

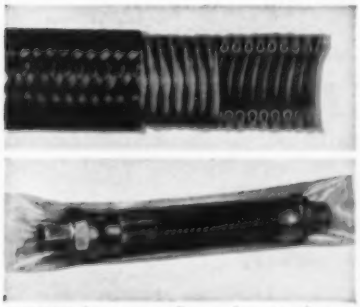
Helpful tips for contractors:

FLEXPIPE UNITS are connected to main pipe before fill and concrete are laid. Flexpipe takes up expansion and contraction between radiator and rigid main underneath the concrete slab. Neat, leakproof, quickly installed!

New Flexpipe flexible connector solves expansion problem on short vertical connections to radiators

In schools, shopping centers and other similar heating installations, the mains are often buried in trenches along the outside walls or below concrete slab floors, leaving short, vertical connections to the radiators right above them.

Here, Flexpipe* flexible connectors have an ideal application. Their flexibility reduces the possibility of breakage and leaks due to expansion. And Flexpipe eliminates the time and materials cost of rigid connections made up of elbows, couplings and short runs of pipe.



FLEXPIPE has core of seamless tin bronze tubing corrugated for flexibility. No packing. 100% tight. Tin bronze wire braid covering for extra strength. Chrome-plated brass pipe fittings attached. Packaged in clear, tough polyethylene bag for easy identification, handling and warehousing.

USE FLEXPIPE TO PERMIT TRAVEL . . . ABSORB VIBRATION . . . CONNECT MISALIGNED PORTS IN PIPELINES

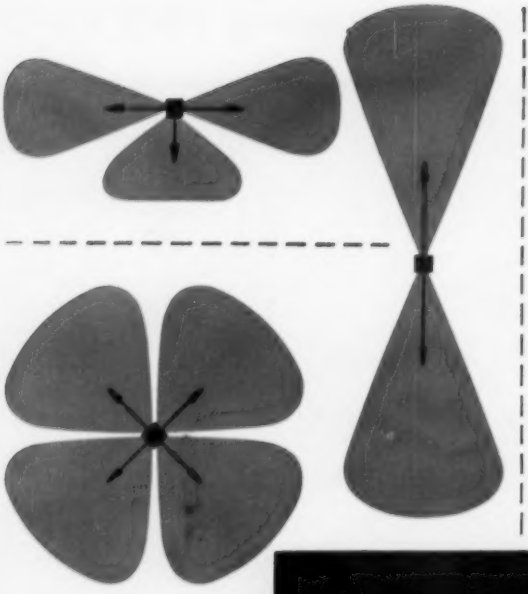
Service. Flexpipe assemblies can be used to convey air, gas, oil, steam or water. They're easy to install even in cramped spaces . . . need no attention once installed. Flexpipe installations dampen noise in piping, take care of expansion and contraction, are long lasting.

Where to buy. Flexpipe connectors come in convenient standard sizes from ¼-inch through 2-inch, and are sold by leading distributors. They can show you samples and answer questions about service applications. For the name and address of the one serving your area, or for more detailed information, write to: The American Brass Company, American Metal Hose Division, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Company, Ltd.

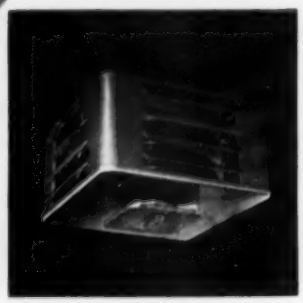
*Trade Mark

Flexpipe

AN ANACONDA® PRODUCT



CARRIER "CLOVER LEAF" IS EASY TO VARY



Carrier's new 4-way Unit Heater, with "clover leaf" pattern, gives you complete control of air distribution. You can vary the length and velocity of the blow. And you can discharge air in 2, 3 or 4 directions at one time. All without changing outlets or adding accessories.

One unit discharging air in 4 directions will cover an area up to 104 feet in diameter. Discharging in 2 directions, length of the blow can be extended up to 136 feet.

Carrier's 4-way Unit Heaters, for use with steam or hot water, come in 8 sizes: 55,000 to 600,000 Btu/hr. Look in your Classified Telephone Directory for the name of your Carrier jobber-distributor.

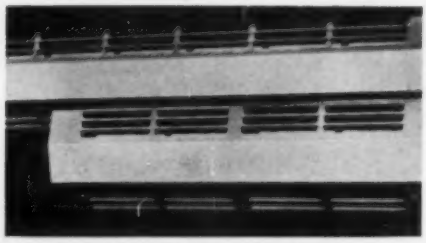
Carrier Makes a Complete Line of Unit Heaters, including this Cabinet Unit Heater that can be fully recessed in wall. Three sizes from 26,000 to 115,000 Btu/hr. Also can be floor mounted, vertically or horizontally hung. With over 50 years leadership in temperature control, Carrier knows heating. Carrier Corporation, Syracuse, New York.

Carrier

industrial heating
air conditioning · refrigeration

EQUIPMENT DEVELOPMENTS

Continued



Electric Baseboard Radiation . . .

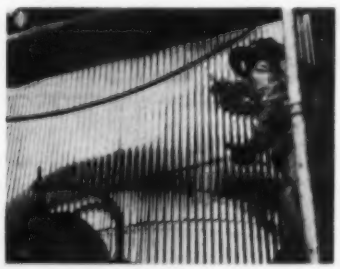
. . .for apartments, motels, offices, etc.—*Crystalheat Co., Dept. HPAC, Van Nuys, Calif.*

Available in modular lengths of 4 ft rated at 1000 watts, 3415 Btu; 2 ft lengths rated 550 watts, 1880 Btu at 220/240 volts. Built-in 115 volt wall receptacle, styled to become part of regular baseboard heater, available as accessory.

Air Turning Vane Material . . .

. . .designed for making single or hollow vanes for square elbows available in continuous coil form — *Duro-Dyne Corp., Dept. HPAC, New Hyde Park, N. Y.*

Previous packages in bundles of strips still available, says company. To make vane: appropriate length is cut from coil; vanes, sheared from scrap, are inserted in grooves of rail; blow of broad point chisel on protruding portion of vane in each slot locks vane tightly, says company.



Aluminum Jacketing . . .

. . .for tanks, towers, vessels—*Childers Mfg. Co., Dept. HPAC, 3620 W. 11th St., Houston.*

Deep-corrugated material attached with aluminum strapping and seals, or with aluminum sheet metal screws. Available with 1¼ or 2½ in. corrugations. Rigidity increased by cross crimping metal before adding deep corrugations, says company.

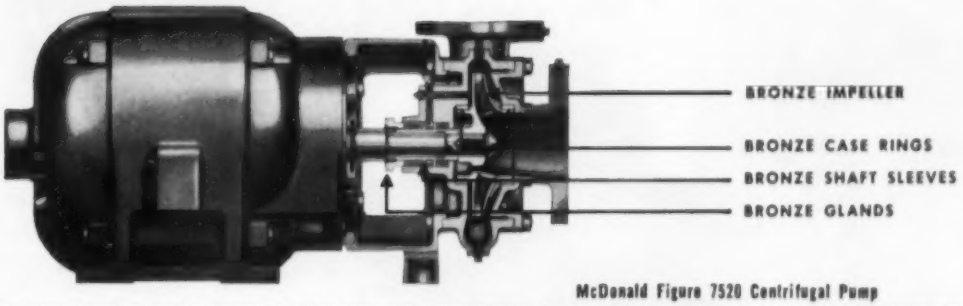
Electronic Air Cleaners . . .

. . .for use in commercial buildings, industrial plants, laboratories, specialized applications — *Trion, Inc., Dept. HPAC,* 1000 *Island Ave., McKees Rocks, Pa.*

"HEV" units are said to have very high efficiency. Cited feature is close coordination with air velocity and space requirements of air conditioning coils.

EXTRA —years— of service

McDonald Close-Coupled Centrifugal Pumps Are Fully Bronze Fitted to Last Longer



McDonald Figure 7520 Centrifugal Pump

Ideally suited for air conditioning applications, industrial and irrigation uses

These dependable centrifugal pumps are good examples of McDonald quality construction. Impellers, case rings, shaft sleeves and glands are all carefully machined from durable bronze to give your customers extra years of trouble-free service.

You can be sure of top performance, too. The pump is mounted directly on the motor frame, and the impeller on the motor shaft to assure correct alignment under all conditions. The volute is ruggedly built and engineered for correct hydraulic relation. Base design eliminates expensive foundations and requires minimum space. N.E.M.A. close-coupled centrifugal pump motors are used exclusively.

Give your customers extra years of efficient, dependable pump service. Specify McDonald Close-Coupled Centrifugal pumps. Send this coupon today for complete information and prices.

McDonald's 100 years of successful pump designing and manufacturing is your assurance of dependable quality

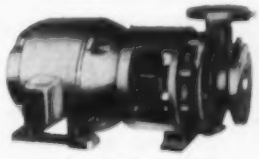
100TH ANNIVERSARY 1856-1956 McDonald YESTERDAY-TODAY-TOMORROW

McDonald Figure 7520

High head centrifugal pumps, capacities to 950 G.P.M. Ideal operating range, 280 feet down to 150 feet T.D.H. Sizes 1½" to 4" discharge; motors 2 to 60 H.P.

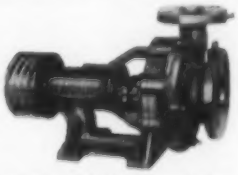
McDonald Figure 7720

Fractional horsepower centrifugal pumps, capacities to 70 G.P.M. Total heads, 20 to 85 feet. Sizes ¾" discharge with ¼ or 1/3 H.P. motors; 1" discharge with ½, ¾ or 1 H.P. motors.



McDonald Figure 7620

Moderate head centrifugal pumps, capacities to 280 G.P.M. Ideal operating range, 150 feet down to 50 feet T.D.H. Sizes 1¼", 1½" and 2" discharge; motors 1 to 10 H.P.



McDonald Belt Driven Units

McDonald close-coupled centrifugal pumps available on frames for belt drive or direct connection with flexible coupling.

A.Y. McDONALD MFG. CO. DUBUQUE, IOWA

PUMPS • BRASS GOODS • OIL EQUIPMENT

Gentlemen: Please send me information and prices on McDonald Centrifugal Pumps.

Name _____

Firm or Business Name _____

Address _____

City _____ State _____

2 Safe Ways to PROTECT Pressure Piping...

W-S SCREW-END and SOCKET-WELDING FORGED STEEL FITTINGS

Pipe joints are potential trouble spots in high pressure piping systems. Change in direction of flow causes turbulence, erosion and vibration. Watson-Stillman fittings are made to absorb this type of punishment. They're drop-forged for strength and toughness and safety-factor designed for the protection of your piping.

Choose between a welded piping system and a screwed one to suit your needs. Then choose W-S Screw-End or Socket-Welding Fittings to join your pipe. They're available in sizes ⅛" to 4" for piping up to 6000 lb. W.O.G. class. For high temperature or corrosive service you can get W-S Forged Stainless and Alloy Steel Fittings, too. Send today for our informative catalogs.

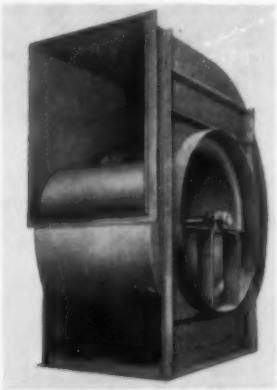
W-S FITTINGS DIVISION

HKP H. K. PORTER COMPANY, INC.

Roselle, New Jersey

EQUIPMENT DEVELOPMENTS

Continued



Centrifugal Fans . . .

. . . with airfoil blading — *Westinghouse Electric Corp., Sturtevant Div., Dept. HPAC, 200 Readville St., Hyde Park, Boston* 30.

"Series 6000 Silentvane" fans engineered for high efficiency in movement of air in high pressure air conditioning, industrial process ventilation. Blade design is said to facilitate lower noise level. Units in 16 models with wheel diameters ranging 27 to 108 in. For direct connection to conventional squirrel cage induction motors operated at standard speeds.

Programming Control . . .

. . . designed to program, safeguard operating sequence of rotary register oil and gas burners — *Electronics Corp. of America, Dept. HPAC, 718 Beacon St., Boston* 15.

"Fireye System FP-2" uses two flame sensitive "Firetron" scanners. One monitors pilot flame, supervises light-off sequence. Other safeguards main flame. Arrangement is said to provide additional safety against off-ratio firing.

The MASSACHUSETTS Line®

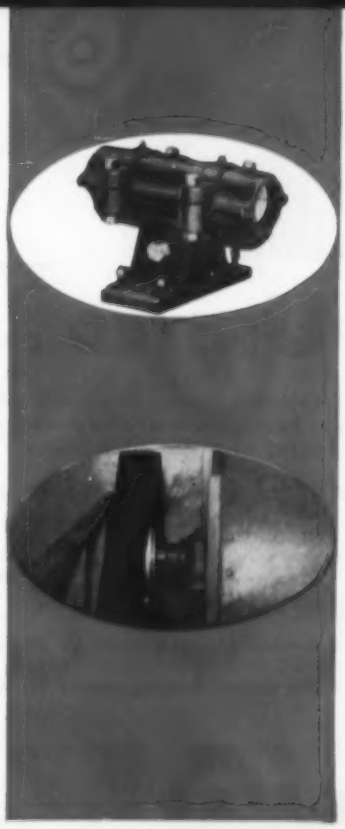
A PERFORMANCE HARD TO MATCH!

MASSACHUSETTS FANS HAVE SERVED KENYON STREET SCHOOL, PROVIDENCE, R. I., CONTINUOUSLY FOR 58 YEARS ! !

Massachusetts Fans installed in 1898 now being replaced due to remodeling. Nineteenth century styling conforming with dated engineering standards.

A NEW UNIT TO EXTEND THE CONTINUOUS SERVICE . . .

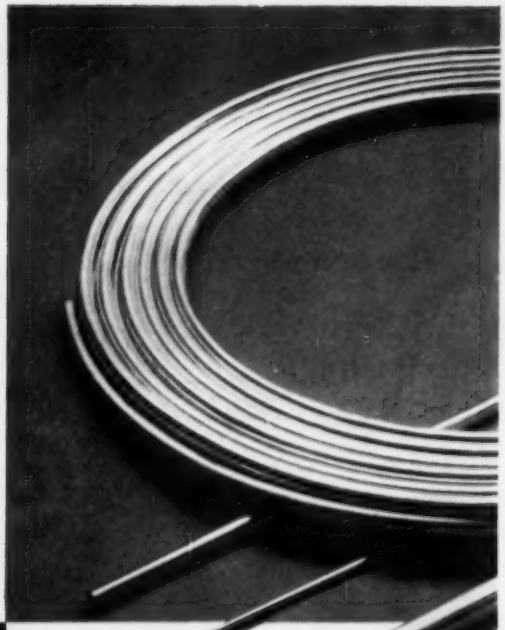
Modern design incorporating improved engineering developments and fabricating methods. Consulting engineers, Hayden, Hadding & Buchanan of Boston.



MASSACHUSETTS BLOWER DIVISION

The BISHOP & BABCOCK Mfg. Co.

4901 HAMILTON AVENUE · CLEVELAND 14, OHIO



Design
QUALITY
into your
installation

Specify

UNITED copper water tube

Combine prompt shipments with quality control production and you have the key to why more and more United copper water tube is being specified and used every day.

- Orders received before noon are shipped that day! (from main plant or warehouses in key cities).
- Every inch of United copper water tube is produced under strict quality control . . . in a precision tube mill where the most rigid requirements are commonplace.
- Available in color coded 20′ straight lengths and 60′ coils.
- For radiant heating, specify ¼, ⅜ and ½ type L in 100′ coils.

For permanently united copper joints — braze with PHOSON!

Permanently United

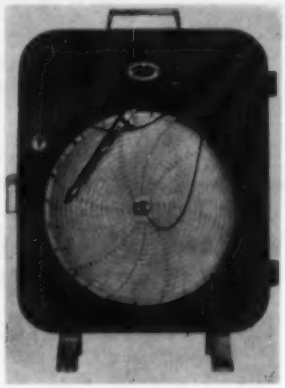
UNITED WIRE
AND SUPPLY CORPORATION

PROVIDENCE 7, R. I. • OFFICES IN PRINCIPAL CITIES

LOOK TO UNITED FOR THE BEST IN ALUMINUM, COPPER AND BRASS TUBE AND WIRE

EQUIPMENT DEVELOPMENTS

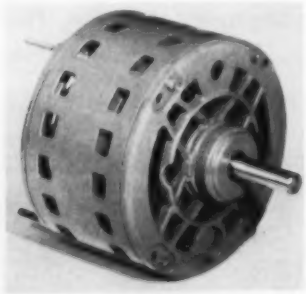
Continued



Recording Thermometers . . .

. . . for recording, maintaining temperature test records where reference for future use is required — *Weksler Thermometer Corp., Dept. HPAC, Freeport, L. I., N. Y.*

Mercury or vapor actuated, unit is supplied with 8, 10 or 12 in. chart. Equipped with carrying handle, stand legs, brackets for coiling connection tubing at rear of case.



Shaded Pole Motor . . .

. . . with positive reversible feature at high speed — *General Electric Co., Dept. HPAC, Schenectady 5, N. Y.*

Operates without capacitor, with low reversing current, says company. Suited for use in evaporative coolers, exhaust and circulating fans, similar air moving devices with moderate radial and axial thrust loads. Available 1/15 to ⅛ hp with single, dual speeds.

Air Cooled Condensers . . .

. . . designed for installations beyond 100 tons — *Kramer Trenton Co., Dept. HPAC, Trenton, N. J.*

"Giant-sized Unicons" are said to

Our challenge stands

—anything that can be made of steel sheets can be made of

WHEELING

SOFTITE®

Galvanized Sheets

Believe it or not, this galvanized recessed ceiling light reflector housing was made by spinning. *"Impossible,"* you say? *"Can't be done with ordinary galvanized steel"?*

You are right! It *isn't* made of ordinary galvanized steel.

It's made of Wheeling SOFTITE, the tightest-coated galvanized sheet yet produced. So tight it won't chip, crack, flake or peel no matter how severely it is formed. It even takes *spinning* in its stride. In fact, *anything* that can be made of steel sheets can be made of Wheeling SOFTITE.

That's SOFTITE . . . made by the same company that developed Cop-R-Loy, the original copper-bearing steel pipe . . . and DUCTILLITE, the original cold reduced tin plate. Now SOFTITE, the ultimate in ductile, tight-coated galvanized steel sheets . . . a product of Wheeling Steel Corporation, Wheeling, West Virginia.

IT'S WHEELING STEEL

District Offices — Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Houston, New York, Philadelphia, St. Louis, San Francisco

EQUIPMENT DEVELOPMENTS

Continued

have very low operating noise level. Each unit has two fans driven from single motor. Unique motor mounting used to permit easy belt adjustment, says company. Units also available for air-to-air heat pump application.

Oil Burner Controls . . .

. . . for continuous, intermittent ignition service — *Penn Controls, Inc., Dept. HPAC, Goshen, Ind.*

Cited features of new stack controls include low voltage protection in addition to "automatic" recycling with timed purge period. "Type 682" intermittent unit recycles on flame failure or power interruption during burner *on* cycles. Brief scavenger period allows fumes to leave combustion chamber. "Type 680" continuous ignition control recycles only in event of power interruption.

Solenoid Valve . . .

. . . with "in-line" construction — *Airmatic Valve, Inc., Dept. HPAC, 7317 Associate Ave., Cleveland 9.*

Feature is said to provide for easy inspection, service of two-way direct solenoid controlled unit. All control parts can be removed in one assembly, without disturbing piping, says company. Primarily for a-c applications. Normally closed unit in standard pipe sizes ¼ to 2 in.

Fractional Hp Motor . . .

. . . for air conditioning, refrigeration applications — *Redmond Co., Dept. HPAC, Owosso, Mich.*

"AM-4 MonoMotor" is lightweight, single bearing, "all-angle" unit; has interchangeability feature to accomodate all standard brackets and special mounts, says company. Rated 1½ to 16 watts, unit is of four pole design, 1550 rpm, 115 volts, 60 cycles. Is also available in odd voltages, frequencies.

REED

This new Reed Tube Cutter—a faster, lighter-weight roller cutter—is the first cutter for 1" to 3" copper tubing; equally ideal for brass and aluminum tubing from 1" to 3".

New TC3 TUBE CUTTER!

PATENT PENDING

SO light that it weighs just a fraction as much as conventional pipe cutters in the same size range, this new Reed TC3 Tube Cutter does a faster, more convenient cutting job on 1" to 3" tube of copper, brass or aluminum.

THE new Reed TC3, with its single cutting wheel in the movable arm, is far quicker and easier than a hacksaw; the ultra-thin alloy cutting wheel leaves almost no burr; and TC3's lighter pressure avoids distortion of tubing, thereby safeguarding tightness of solder or slip joints. With the single wheel in plain view for lining up with the cut-off mark, the cutter hooks quickly and easily on to tube for a right angle cut.

FRAME of this new Reed TC3 is as light as it is strong and durable because it has been specially-designed of high-grade ductile iron

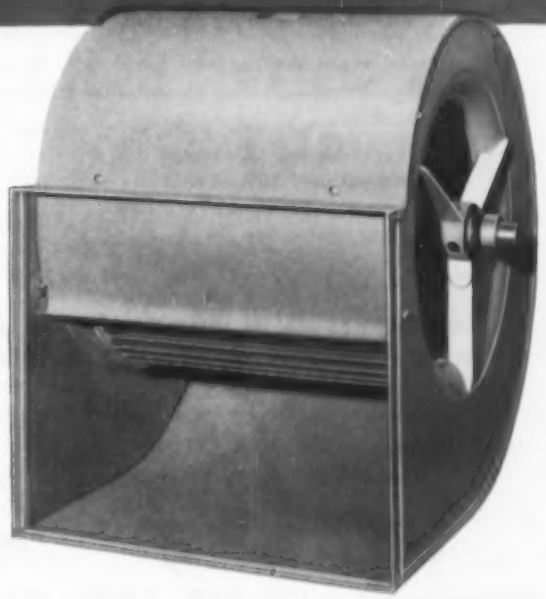
REED MANUFACTURING COMPANY ERIE, PA., U.S.A.

Biggest News in the Air-Moving Industry!

LAU SAVES YOU MONEY!

new Lau "Budget • Blower" is a triumph of economy with quality

With no sacrifice of quality or flexibility, you get the lowest blower price ever with the Lau "Budget • Blower" . . . this, in the face of rising steel costs! Choice of sleeve bearings, ball bearings or famous Lau-Pak Gold Seal bearings . . . Lau scroll sides pre-punched to permit mounting at multiple angles of discharge . . . economies of adaptability, palletized shipping, bulk packaging of hardware . . . quick shipment from stock . . . tangible benefits of 25 years of experience and engineering know-how . . . all at an unheard-of low price with the Lau "Budget • Blower."

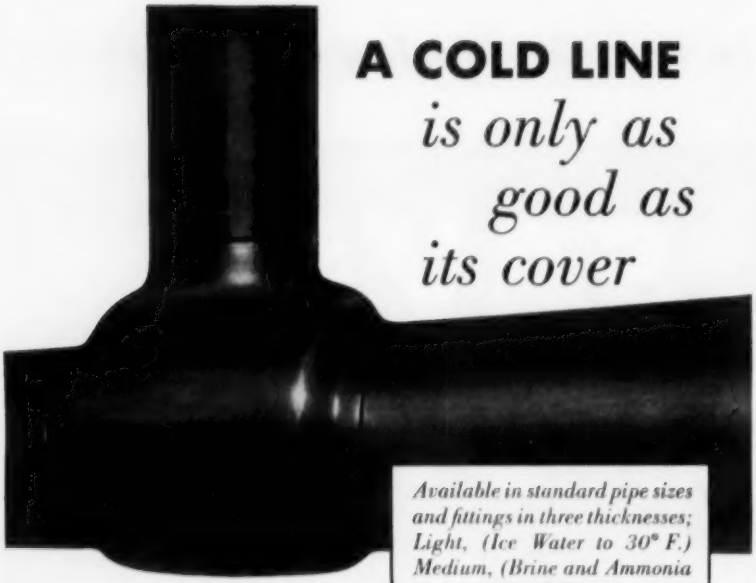


Phone . . . Wire . . . Write . . . or See Your Lau Representative Today!

THE LAU BLOWER COMPANY

2000 Home Avenue • Dayton 7, Ohio

Other plants in Kitchener, Ont., Canada and Azusa, California



A COLD LINE *is only as good as its cover*

Available in standard pipe sizes and fittings in three thicknesses;
Light, (Ice Water to 30° F.)
Medium, (Brine and Ammonia to 0° F.)
Heavy, (Heavy Brine—25° F. and lower.)

UNITED CORK PIPE COVERING

THE IDEAL COLD LINE INSULATOR

A cold line system is only as effective as its insulation. Inferior pipe covering in just one section of the line will cause operating costs to skyrocket and a considerable loss in dollars to the cold storage operator. United's pipe covering gives you the best insulation with all these advantages:

Extremely low "K" factor
Retains over 80% of cold loss on piping
Easy and economical to install
Long trouble-free life
Fire retardant—Vermin resistant
No capillarity

LARGER STOCKS—FASTER DELIVERY—PERSONAL SERVICE

United Pipe Coverings are available from stock for prompt delivery—to fulfill your immediate installation requirements. Mail the coupon below for additional information or the name of the United distributor nearest you.

Corkboard

Pipe Covering

Tank Lagging

UNITED BB CORKBOARD

Manufacturers of cork insulation for almost a half century

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Please send United Cork Catalog. I am interested in

NAME
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Engineering offices, or approved distributors, in key cities—coast to coast.

EQUIPMENT DEVELOPMENTS

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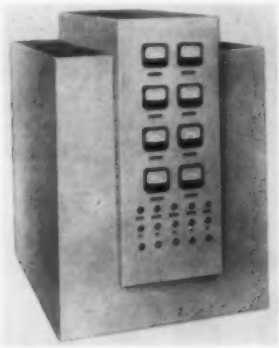
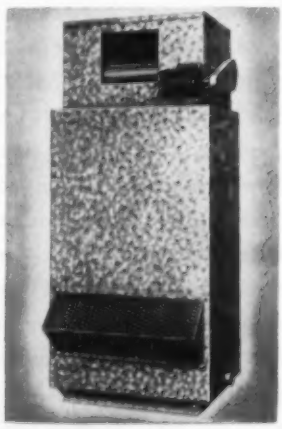


Control Systems . . .

. . . built to order for explosionproof, dust-tight, dripproof, normal commercial uses — *Devco Engineering, Inc., Dept. HPAC, P. O. Box 387, Caldwell, N. J.*

Typical examples include magnetic stirrer controls, controls for sulfite liquor waste evaporators, reactor thermal equipment, ammonia dissociator equipment, operation of autoclaves, feeding, sequencing, warning, signaling.

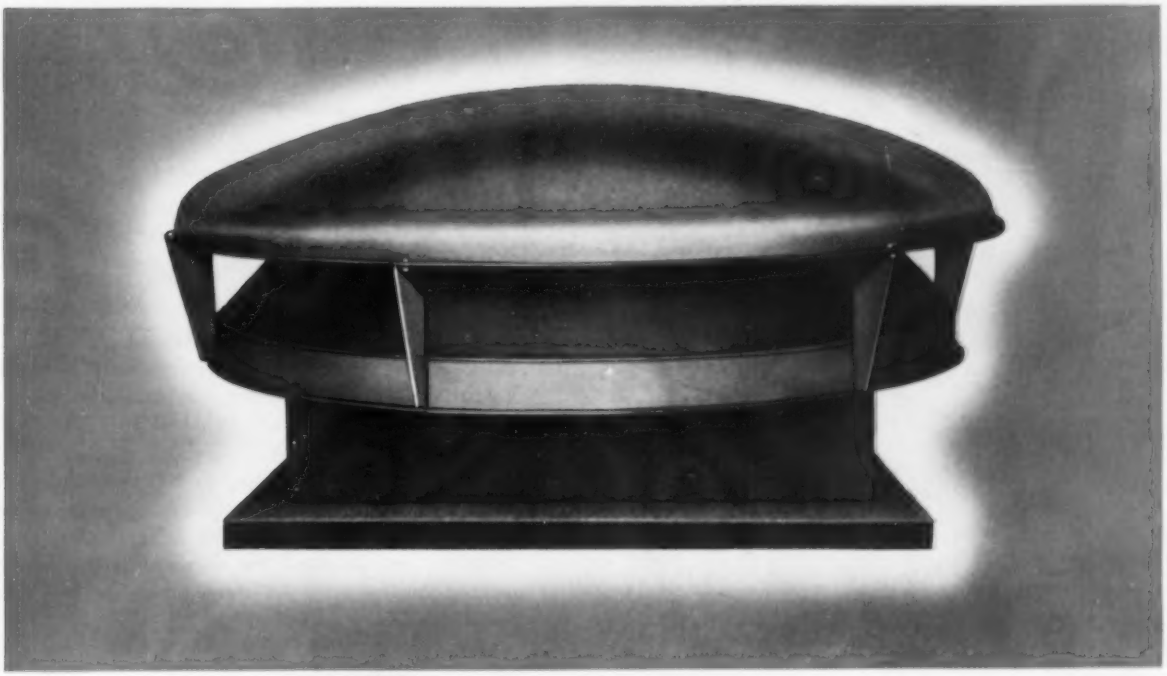


Cooling Tower . . .

. . . for installation where there is problem of limited space — *Dover Mfg. Co., Dept. HPAC, 3117 Weatherford Ave., Independence, Mo.*

Packaged "Series V" vertical induced draft unit has centrifugal blower to provide air flow. Piping, duct work to tower kept to minimum, says company. For interior or exterior installations. Is said to have very low noise level. In capacities 5 to 100 tons.

A ROOF VENTILATOR WITH EYE-APPEAL PLUS HIGH EFFICIENCY



NEW *Allen* "I-LINE" ROOF FAN
Gives You the *LOW CONTOUR* You Want

. . . and with the

FEATURES YOU WANT

- Low silhouette
- Low noise level
- High efficiency
- Rigid construction
- Low first cost
- Low operating cost
- Vibration-free for long life
- Easy to install (no extra base needed)
- Easy accessibility for lubrication, inspection and cleaning
- Versatility (supply or exhaust units)
- Wide capacity range (400 to 34,000 cfm)
- Choice of two types of standard base

The new *Allen* "I-Line" Roof Fan meets the architect's demand for an attractive unit that hugs the roof without sacrificing the high efficiency required by engineers. This is accomplished by a circular spun hood and fan venturi with a directional baffle so arranged in relation to the propeller as to provide maximum efficiency with minimum over-all height.

In addition, the new "I-Line" design makes installation exceptionally easy and the hinged hood simplifies maintenance and cleaning.

The *Allen* "I-Line" Series Roof Fans are available with *Direct Drive* (400 to 34,000 cfm) or with *Belt Drive* (4,000 to 20,150 cfm).

•

See Sweet's (8b/Al) or write for catalog that gives you specifications and complete performance data.

ALLEN ENGINEERED VENTILATION

ALLEN COOLER & VENTILATOR, INC.
ROCHESTER, MICHIGAN

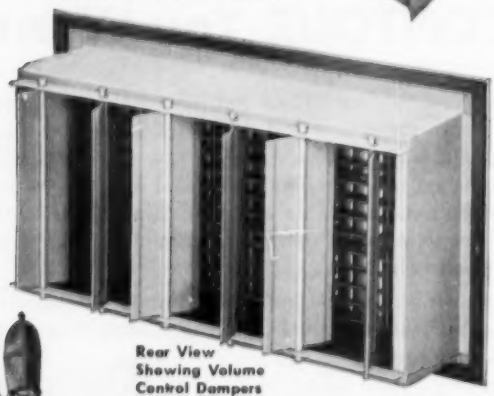
Roof ventilators for every commercial and industrial need • Representatives in principal cities

INDEPENDENT

"Fabrikated"

DOUBLE CORE REGISTERS
with opposed blade dampers
key control
For Commercial Installations

No. 27
Adjustable Vertical Front Bars
Adjustable Horizontal Rear Bars



Rear View
Showing Volume
Control Dampers

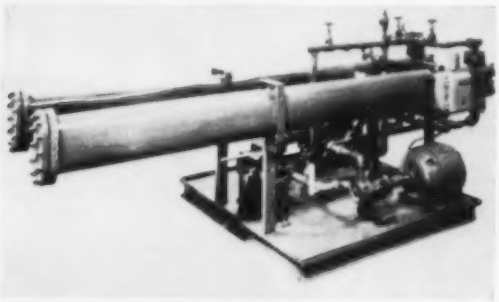
Write for Catalog
No. 56 which gives
complete details and sizes
up to 48" x 24"

Always Leading—
Always Progressing

THE INDEPENDENT
REGISTER CO.
3747 E. 93rd STREET • CLEVELAND, OHIO

EQUIPMENT DEVELOPMENTS

Continued



Fuel Oil Pump, Heater Sets . . .

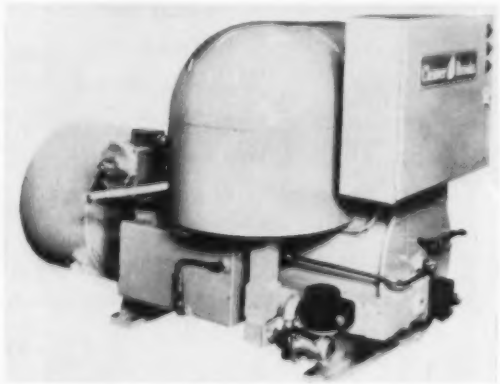
. . . engineered to control pressure, viscosity of heavy industrial fuel oil for better combustion results — *Walter H. Eagan Co., Inc., Dept. HPAC, 2336 Fairmount Ave., Philadelphia.*

Units heat to 300 F, pump to 400 psi, handle capacities to 3000 gph, says company. Single or duplex sets available for steam or electric drive. Duplex "electrosteam" sets provided for electrical failure conditions by incorporating one steam pump and one electric motor driven pump.

Fly Ash Collector-Induced Draft . . .

. . . combination unit designed to remove fly ash, soot, cinders from stack gases and provide draft for boiler operation—*Breslove Separator Co., Dept. HPAC, Commonwealth Bldg., Pittsburgh* 22.

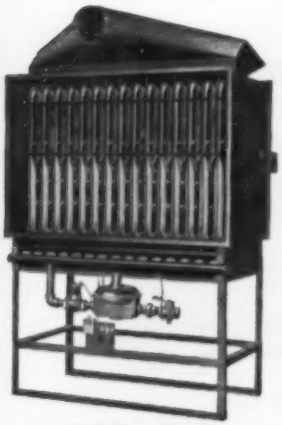
Collector is regenerative type. Low draft loss of collector keeps fan speed, power requirements low while high collection efficiency keeps stack discharge clean, says company. Combination unit designed for easy installation. For use with new, existing boilers.



Air Atomizing Burner . . .

. . . designed to burn No. 6 oil—*Cleaver-Brooks Co., Dept. HPAC, 326 E. Keefe Ave., Milwaukee* 12.

Gun type unit is said to be first of its type developed for burning No. 6 oil. Air, oil metered in proper ratio at all capacities to facilitate maximum efficiency, says company. "Hev-E-Oil" unit burns 90 gph of oil.



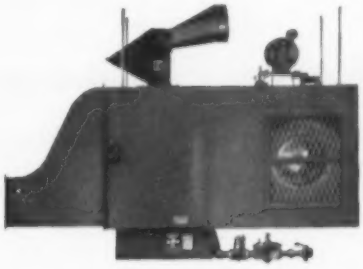
MODEL SED-E

MODEL SED-S

MODEL SED-VF

MODEL SED-E — Non-corrosive type 321 stainless steel heat exchanger. Permits installation downstream of cooling equipment, for continuous blower operation. Air throughput in either direction. 80,000 to 600,000 Btu input.

MODEL SED-S — Same as SED-E except controls are at the side, instead of at the end where accessibility requires either SED-E or SED-S is available in sizes from 80,000 to 600,000 Btu input in increments of 40,000 Btu.



MODEL SEU

MODEL SED-VF — Tested and approved as a duct furnace; type 321 stainless steel. Re-circulated or fresh air enters through bottom, sides, or back. Built-in air bypass, vent in front. Sizes from 70,000 to 245,000 Btu input.

MODEL SEU — Suspended unit heater. Recirculates room air. Diffuser outlet with adjustable vertical and horizontal vanes. Double inlet forward curve blower. Continuous duty, variable pitch drives, raised port burners. 80,000 to 600,000 Btu input.

MODEL SEC

HAYES

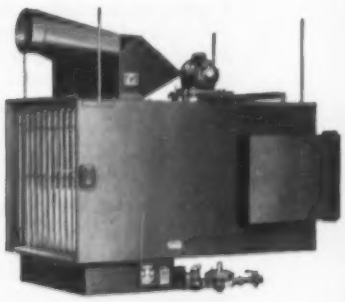
FURNACES

outstanding for commercial, industrial, schools, churches, theaters, large residential

HAYES FURNACE MFG. & SUPPLY CO.

3233 So. La Cienega Blvd., Los Angeles 16, California

Telephone TExas 0-3734



MODEL SES

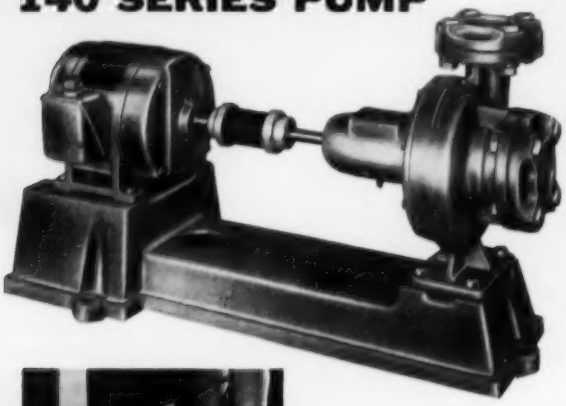
MODEL SEC — Forced air furnace. Stainless steel heat exchanger sections seam and arc welded. One piece cast iron burners with drilled ports. Oversize double inlet blower, glass or washable filters. 6 sizes — 70,000 to 245,000 Btu input. For zero clearance.

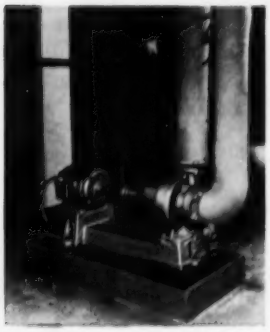
REPRESENTATIVES

M. Blazer & Son, Passaic, New Jersey.
Blue Flame Supply Company, Atlanta, Georgia
Eugene Bolstad, Edmonton, Alberta, Canada.
E. B. Bomar, Phoenix, Arizona.
Boyd Engineering Co., El Paso, Texas.
Roube O. Emery, Nashville, Tennessee.
F & D Distributors, Salt Lake City, Utah.
Leudecke Engineering Co., Austin, Texas.
McCombs Supply Co., Denver, Colorado.
O'Connor-Oklahoma Co., Oklahoma City, Tulsa, Oklahoma & Wichita, Kas.
Smith Steam Specialty Co., Kansas City, Mo.
Tay-Holbrook, Inc., San Francisco, California.
F. R. Young, Houston, Texas.
Dealers Supply Company, Atlanta, Georgia.
Jewell & Company, Hot Springs, Arkansas.
Nunn Electric Co., Lubbock, Texas.
Noland & Co., Newport News, Va.
Temp-Control Corp., Portland, Oregon

MODEL SES—Forced air, suspended furnace for installation in suspended duct system. Inlet and outlet designed for sheet metal duct connection. Double inlet forward curved blower. Continuous duty variable pitch drives, raised port burners.

NEW FROM TACO
140 SERIES PUMP





For quiet, vibrationless operation and rugged dependability on large installations

Designed specifically for heating and cooling systems requiring quiet, smooth operation, the new Taco No. 140 series pump offers a host of outstanding features:

- Water-tight, self-adjusting, self-lubricated mechanical seals.
- A motor selected for quiet operation, equipped with oil lubricated, bronze sleeve bearings.
- A spring drive coupling which easily absorbs starting torque and designed for quiet operation.
- A long-life impeller shaft of stainless steel, hardened and ground to a mirror finish.
- Bronze bearings in bracket, separated by a thrust collar attached to the shaft, absorb all end thrust.
- An oil bath circulating system with modern slinger rings, lifts oil to both bronze bearings.
- Bearing bracket, impeller and shaft are completely removable without disturbing motor, volute or piping connections.
- A closed type impeller of bronze or cast iron, dynamically balanced for smooth noiseless operation and designed to eliminate hydraulic thrust.
- Volute on body legs bolted directly to the base prevent piping strains from changing pump alignment.
- A base of cast iron designed with a three-point floor mounting to simplify leveling. Provision is also made to fill with concrete for sound deadening.

For the features that mean a better performance for every large hot water heating or cooling system, put the new Taco No. 140 series pump on the job!

Better Heating — Taco — Better with Taco

TACO HEATERS, INCORPORATED
1160 Cranston St., Cranston 9, R. I.

EQUIPMENT DEVELOPMENTS

Continued

Electronic Control Panel . . .

. . . for air conditioning control in stores, offices—*Minneapolis-Honeywell Regulator Co., Dept. HPAC, 2641 Fourth Ave., S., Minneapolis 8.*

Designed for installation in manager's office, lets him control customer comfort from his own desk. For flush mounting on wall.

Pyrometry Instrument . . .

. . . for measuring temperature of hot gases in difficult situations where gas temperatures and surroundings are constantly changing—*Fielden Instrument Div., Robertshaw-Fulton Controls Co., Dept. HPAC, 2920 N. Fourth St., Philadelphia 33.*

Designed to measure gas zero to 2900 F. Cited applications: water tube boiler furnaces, uptakes and regenerators of open hearth furnaces; other industrial and laboratory applications.

Float Control Valve . . .

. . . designed for mounting with discharge in either upward or downward position, inside or outside of water vessel—*Maid-O'-Mist, Inc., 3217 N. Pulaski Rd., Chicago 41.*

Unit is heavy duty, large capacity, diaphragm type with cast brass body, which is fitted with removable chromium valve seat. Opening, closing of valve accomplished through action of oversized copper float, linkage and neoprene diaphragm.

Air Conditioners . . .

. . . in 1957 "advance series" — *Mitchell Mfg. Co., Div. of Cory Corp., 2525 N. Clybourn Ave., Chicago.*

Line consists of ¾, 1 hp models. Cited features are: "power pack" chassis containing newly designed refrigeration unit, 1450 rpm fan motor, oversized blower wheel; compact cabinet and installation kit; thermostat; "sound conditioning."

THE NEW *Airtherm* AIR CONDITIONING UNIT

REMOTE TYPE FOR HEATING • COOLING • VENTILATING

OFFERS THE BEST FEATURES AVAILABLE IN THE INDUSTRY

FOR NEW OR MODERNIZED

√OFFICES √APARTMENTS

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√HOTELS √PUBLIC BUILDINGS

The new Airtherm Unit uses a central source of hot water for heating, chilled water for cooling and combines the best features the industry has developed through the years.

This "Feature Research" guarantees you the greatest possible versatility of installation, efficiency of operation and dependability.

Airtherm Units are made in four series, from ½ to 2 ton nominal cooling capacity, for cabinet or concealed type installation, floor or ceiling.

We'll be glad to send you complete specifications if you will send us the coupon below.

MAIL COUPON FOR SPECIFICATIONS

AIRTHERM HEATING AND VENTILATING PRODUCTS

Cabinet Unit Heater

Gas Fired Unit Heater

Propeller Fan Unit Heater

Convector

Centrifugal Fan Unit Heater

Direct Fired Space Heater

Airtherm Manufacturing Co. Dept. A
700 S. Spring • St. Louis 3, Mo.

Please send me complete specifications on your new Airtherm Air Conditioning Units, Cabinet Unit Heaters, Convectors, Gas Fired Unit Heaters, Propeller Fan Unit Heaters, Centrifugal Fan Unit Heaters, Direct Fired Space Heaters. (Circle those desired.)

NAME_____

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STREET ADDRESS_____

CITY_____ STATE_____

SOLENOID VALVES
Simplify Valve Selection
Reduce Inventory and Parts Stock

You can use *the same* J-E Solenoid Valve to control the flow of *any* of the above fluids, as well as air, brines, light oils, industrial gas, etc. In addition, one size coil (in a variety of voltages) and one plunger fit all valves regardless of size or capacity.

This versatility saves valuable time and trouble in selecting the proper valve for a wide variety of applications. Their unique "all purpose" design also saves important money by greatly reducing inventory and parts stock.

It will pay you to find out about *all* the advantages of J-E Solenoid Valves including . . . simple installation . . . dependable performance . . . quiet operation . . . easy maintenance. Then you'll know why they are being used with enthusiasm and satisfaction in hundreds of applications where other solenoid valves have failed.

Call your wholesaler or write direct today:

J-E
Controls Division
JACKES-EVANS MANUFACTURING CO.
4427 Geraldine Avenue • St. Louis 15, Missouri

EQUIPMENT DEVELOPMENTS *Continued*

Booklet, Template Guide . . .

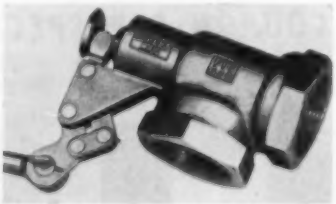
. . . listing JIC symbols for pneumatic valve controls — *Ross Operating Valve Co., Dept. HPAC,* 120 *E. Golden Gate Rd., Detroit* 3.

Forty page booklet is ready reference compilation of symbols, says company. Drafting template guide, which accompanies booklet, designed to aid in quick drafting of desired symbols. Booklet's coding system keys symbols to guide code and catalog number.

Plaster Groover . . .

. . . designed for laying of metal tubing, electrical conduit quickly, easily — *Wodack Electric Tool Corp., Dept. HPAC,* 4627 *W. Huron St., Chicago* 44.

Feature is connection for attaching hose of commercial vacuum cleaner to solve plaster dust problem, says company. Unit consists of: case, which houses a-c/d-c motor; abrasive wheel; handle.



Float Valve . . .

. . . with compound lever mechanism — *Robert Mfg. Co., Dept. HPAC,* 9035 *Venice Blvd., Los Angeles* 34.

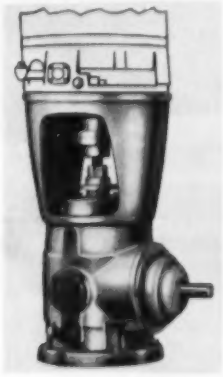
Made of brass in sizes 1¼ and 1½ in. Designed to accurately maintain liquid levels with positive shutoff. Applications include large cooling towers or evaporative air conditioning units, evaporative condensers, industrial processing, water storage tanks.

EQUIPMENT DEVELOPMENTS
Continued

Cast Iron Boilers . . .

. . . for small commercial applications — *Thatcher Furnace Co., Dept. HPAC, Garwood, N. J.*

Cited features for oil fired "Oilmaster 56" series include permanently sealed tongue and groove joints, five-way fire travel, extended fins. In six units, three each for steam, water. Gross IBR ratings at output range 97,000 to 168,000 Btu.



Combination Drive . . .

. . . for continuous pumping operation — *U. S. Electrical Motors, Inc., Dept. HPAC, Box 2058, Terminal Annex, Los Angeles 54.*

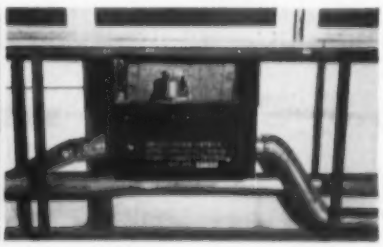
Engineered for installations where continuous or standby service is essential. "Holloshaft Type GPC" in sizes 30 to 150 hp, in selection of gear ratios. In normal operation, electric motor, mounted on disengaged drive, powers pump. In event of power failure or motor breakdown, drive is quickly and easily engaged to transmit power from standby combustion engine, says company.

In San Antonio's new United Services Automobile Association Building . . .

Flexible Thermaflex® delivers year-round comfort!

Atlee B. & Robert M. Ayres and Phelps & Dewees & Simmons, Associated Architects; A. J. Monier & Co., Mechanical Contractors; Henry C. Beck Construction Company, General Contractors; United Services Automobile Association, Owners — all of San Antonio, Texas.

Comfort under any weather conditions is a certainty for the occupants of this fine, modern building. The double-duct, high-velocity system supplies both hot and cold air to thermostatically-controlled mixing boxes which deliver air of the pre-determined temperature through high induction diffusers. Thermaflex is used as connectors between main ducts — both hot and cold — and the mixing boxes.



The ready flexibility of Thermaflex ducting saved time and money in this installation. Boxes and diffusers could be located in best operating position — Thermaflex eliminated alignment problems in connections with main ducts. Many of the offices have thermostatically-controlled mixing boxes under windows, used with grille-type outlets. Here's a good example of the ease with which Thermaflex joins main ducts and mixing boxes — eliminating costly and complicated fitting that would be required if rigid ducting were used here.

Laboratory tests have proved that Thermaflex will stand 1200° F. without any sign of combustion or melting — and that it will stand pressure of 25 psi, which is 5 times the minimum standards of the New York Board of Standards and Appeals. Thermaflex bends around corners and obstructions with minimum friction loss — no costly elbows or fittings are needed.

Flexible Tubing
CORPORATION
GUILFORD, CONNECTICUT • LOS ANGELES 64, CALIFORNIA

Send the coupon today! Our engineers will show you how Thermaflex can save you up to 32% on installation costs.

Flexible Tubing Corporation, Dept. 79, Guilford, Connecticut
Please send me more information on Thermaflex.

Name_____
Title and Company_____
Address_____
City_____ Zone____ State_____

• Soap solution • Calcium hypochlorite •

• Water containing abrasive particles • Carbon slurry • Ferric hydroxide •

Soap solution containing sand and ground glass • 25% grape juice concentrate •

• 50% caustic soda • Ferric sulphate • Ammonium sulphate • Demineralized water

Trisodium phosphate • Reactivated carbon • 1% chlorine solution • Sulphuric acid •

• 10% chromic acid • Humic acid • • Weak black liquor •

Waste sulphite liquor • Bleach liquor • • Slurries

Acid mine water • Liquid latex •

• Alkylaryl sulfonate •

• Sodium hydroxide •

• Calcium hydroxide •

• Calcium bisulphite •

Calcium hypochlorite •

• Demineralized water

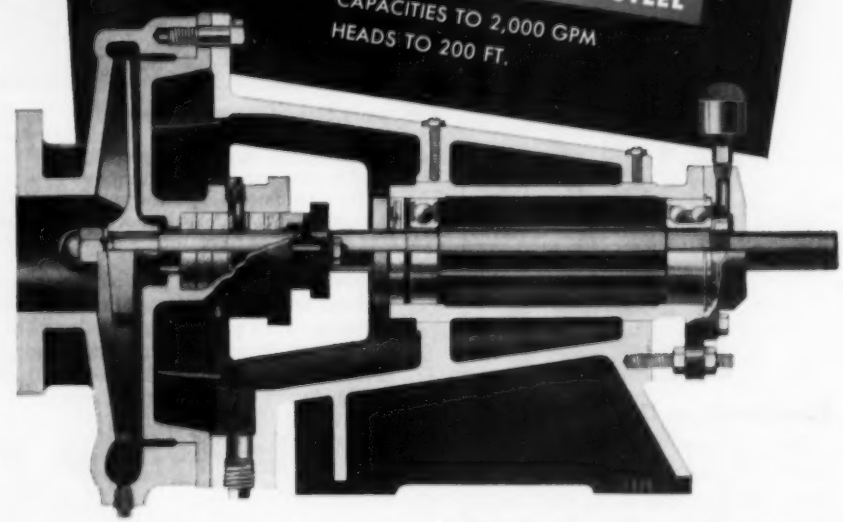
One pump handles all these problem liquids

DE LAVAL

CPO PROCESS PUMP

WITH KK-20 STAINLESS STEEL

CAPACITIES TO 2,000 GPM
HEADS TO 200 FT.



The De Laval CPO Process Pump has stainless steel parts where it comes in contact with the liquid. The casing, end head, stuffing box, impeller, seal ring and gland are all of De Laval KK-20 (20-28 stainless with molybdenum and copper). The shaft and lock nut are made of other suitable stainless steels. • Three bearing pedestals accommodate nine wet end sizes. Off-the-shelf parts in ferrous and nonferrous combinations permit changing size or metallurgy after installation. CPO pumps are available with both conventional packing and mechanical seals.

WRITE FOR BULLETIN 1125-B

DE LAVAL *Centrifugal Pumps*

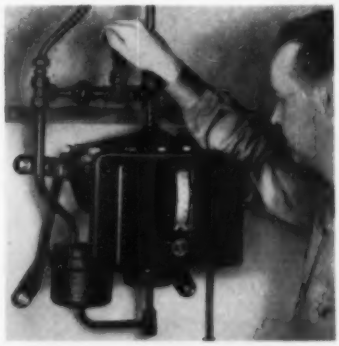
DE LAVAL STEAM TURBINE COMPANY

871 Nottingham Way, Trenton 2, New Jersey

DL-931

EQUIPMENT DEVELOPMENTS

Continued



Flow Transmitter . . .

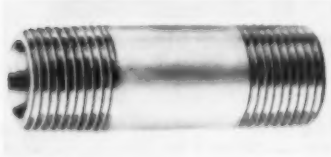
. . .for pneumatic square root extracting — *Bailey Meter Co., Dept. HPAC,* 1050 *Ivanhoe Rd., Cleveland* 10.

High pressure, high velocity may now be measured, transmitted pneumatically on linear flow basis, says company. High-head unit designed to convert differential pressure to rate of flow. Cited features are: low cost, accuracy, rangeability, simplicity, flexibility. Engineered to measure flow rates of steam, water, other liquids and gases producing maximum differentials 100 to 1200 in. water.

5 Ton Conditioner . . .

. . .designed for easy installation — *General Air Conditioning Corp., Dept. HPAC,* 4542 *E. Dunham St., Los Angeles* 23.

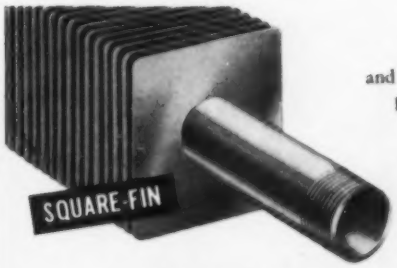
Can be installed as window unit or against outside wall. Units completely packaged, charged and wired. Operate on standard outlet. Can be utilized for year 'round comfort with heat pump, says company.



Nipples . . .

. . .added to company's line of steel pipe fittings — *Pittsburgh Pipe & Coupling Co., Dept. HPAC, Allison Park, Pa.*

Standard and extra heavy "Anvil" nipples broadens line of forged seam-



All *Slant-Fin* products — heating elements and enclosures — are advance-engineered and built to exacting specifications. Regardless of the application, *Slant-Fin* can meet your requirements either with a standard item from an extensive line or fabricate an assembly for your special needs.

WHEN YOU NEED FINNED-TUBE FOR HEATING...REMEMBER THESE

5 reasons

WHY YOU SHOULD ALWAYS SPECIFY

SLANT-FIN

1. Highest heat output

You have a choice of heating elements — the traditional Square-Fin Series or the distinctive Slant-Fin Series with many exclusive advantages. With greater surface per fin and interlocking fin-and-flange construction, these elements supply a high heat output per linear foot. A variety of fin spacings and tube sizes from ¾" to 2" provide a complete range of approved ratings.

2. The most complete line for commercial heating

For office buildings, factories, churches, schools, hospitals and other large area heating installations, *Slant-Fin* radiators and enclosures are unsurpassed. Heating elements in 1¼" and 2" all-steel, all-copper or copper-aluminum provide maximum heating efficiency with economical material and labor costs. A wide range of enclosures from the practical expanded metal to the ultra-modern "low line" permits complete flexibility for individual requirements.

3. Residential baseboard, too

For private offices, hotel rooms, motels, or any small space where both heating efficiency and appearance are desired, *Slant-Fin's* complete line of residential baseboard is ideal. Again, you have a wide choice. Four different heating elements of ¾", 1" and 1¼" are available in all-steel or copper-aluminum. Three different enclosure styles, too.

4. Labor and material savings

Slant-Fin products are made to be installed in the shortest possible time. For example, snap-on enclosures eliminate the need for screws, tools or special mountings. And both heating elements and enclosures are supplied in pre-cut lengths, tailored to your job.

5. Special applications

For special industrial and commercial process applications, either heating or cooling, *Slant-Fin* has the engineering experience and exclusive production techniques to fabricate finned-tube to the user's particular needs. Whether made of stainless or galvanized steel, wrought iron or aluminum, the finished assemblies will meet the most rigid tests for quality construction and efficiency.

You owe it to your reputation to include Slant-Fin in your plans. Catalog 1000 describes Slant-Fin's commercial and residential line. Write today for your copy.

SLANT-FIN RADIATOR CORPORATION

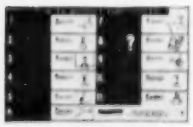
87-49H 130th Street • Richmond Hill 18, New York

Bronze Globe Valves

14 DIFFERENT MODELS— ONE FOR YOUR SPECIFIC REQUIREMENTS

• R-P&C's complete valve line includes 14 different models of bronze globe valves, each in a complete range of sizes. Ranging in pressure classes from 125 to 300 lbs., they include flanged or screwed ends, union or screwed bonnets and a variety of seat and disc constructions. One of these 14 valves will solve your particular problem.

For example, **Fig. 427-DP** above was developed specifically for services where control or regulation of flow is required. The full-plug construction permits closer regulation—and the stainless steel seat and disc (500 Brinell) resist wire-drawing, give longer life. Rated for 300 lbs. Steam—1000 lbs. OWG.



FREE WALL CHART
"How to Protect Your Valves"
22" x 17" wall chart gives installation and operation pointers. Tells how to protect valves, prolong life. Write for your copy.

The **Fig. 1-A** valve, rated for 150 lbs., was developed for applications requiring tight shut-off and frequent operation. The special asbestos-composition disc seats tightly even if particles of foreign matter are trapped between seat and disc. The disc is easily renewed.

No matter what your requirements in bronze globe valves, R-P&C has the answer. And this holds true for angles, gates and check valves in iron and cast steel, also forged steel gates. See your R-P&C dealer today, or write for catalog.

ACCO

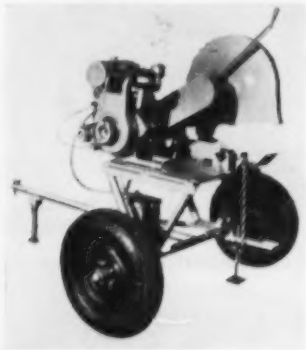
R-P&C Valve Division
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

R-P&C valves

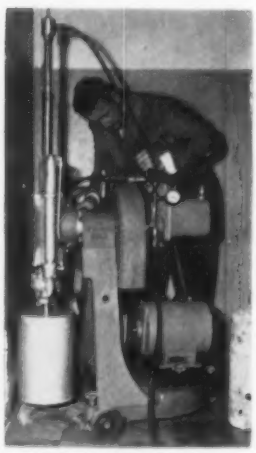
EQUIPMENT DEVELOPMENTS
Continued

less and wrought steel pipe fittings, including couplings, bushings, plugs,



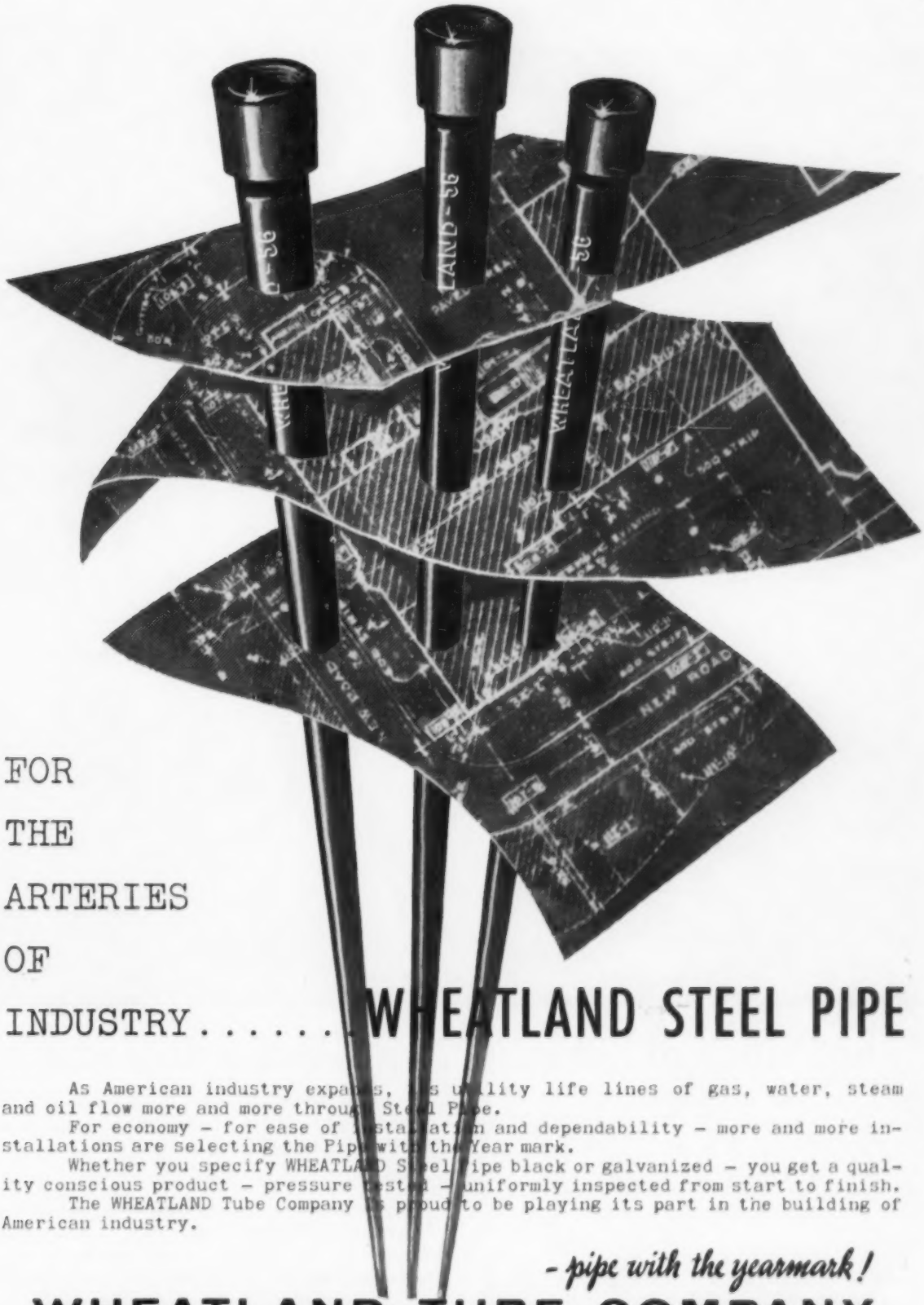
Abrasive Cutting . . .
. . . machine mounted on pneumatic tired trailer — *Beaver Pipe Tools, Inc., Dept. HPAC, Warren, Ohio.*

Unit is new version of company's "No. 20 Speed-Cut" machine. "Car-Trailer" can be gas engine or motor driven, says company. Can be taken right to job, pulled by truck, jeep or car.



Drilling Machine . . .
. . . with hydraulic feeding mechanism, swivel head — *Molco Drilling Machines, Inc., Dept. HPAC,* 1100 *20th St., N. W., Washington* 6, *D. C.*

Designed to drill 1 to 14 in. holes through reinforced concrete, brick, tile at any angle at high speeds. Bits fed "automatically" into work surface by hydraulic feed system. Machine can be equipped with electric or gasoline power.



FOR
THE
ARTERIES
OF
INDUSTRY.....WHEATLAND STEEL PIPE

As American industry expands, its utility life lines of gas, water, steam and oil flow more and more through Steel Pipe.

For economy – for ease of installation and dependability – more and more installations are selecting the Pipe with the Year mark.

Whether you specify WHEATLAND Steel Pipe black or galvanized – you get a quality conscious product – pressure tested – uniformly inspected from start to finish.

The WHEATLAND Tube Company is proud to be playing its part in the building of American industry.

– pipe with the yearmark!

WHEATLAND TUBE COMPANY

Bankers Securities Building, Philadelphia 7, Pa. Mills · Wheatland, Pa. · Delair, N.J.

"The Pritchard LoLine is 7 ways better than what?"

"Seven ways better than competition."

"*Which* competition?"

"*Any* competition!"

"That expression has always bothered me in advertising. I just had to call you on it."

"Bothers me, too."

"Well, what are the seven ways?"

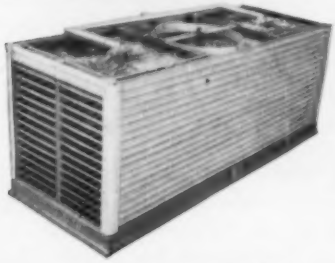
"First, it's the lowest silhouette tower. It has galvanized steel fan drive supports, not less durable painted steel. Grease fittings for the V-Belt drive bearings are on the outside; easier to get to. Then, corrugated rather than flat asbestos cement board casing gives a more attractive appearance."

"That's four."

"Let's see. Five, asbestos cement board louvers are standard, not special equipment. Then, with the LoLine, you get an internal pipe supply system. Piping is concealed. Last, the V-Belt drive has a stainless steel fan shaft. Lasts far longer."

J. F. PRITCHARD & CO. OF CALIFORNIA
4625 Roanoke Parkway, Kansas City 12, Mo.

"The Pritchard LoLine is 7 ways better than what?"



PRITCHARD LOLINE® HAS LOWEST SILHOUETTE OF ANY TOWER 75 TONS AND UP!

The Pritchard LoLine Tower is the lowest silhouette tower of all. Just 7′, 7 11/16″ over-all height. Thus, it best meets the needs of architects in planning for suburban or metropolitan buildings.

Besides that, the LoLine has:

- **Select Heart redwood or better in all framework. Framework is surfaced, machine fabricated for precision fit.**
- **Each set of louvers has slip-fit inserts of cement asbestos board, individually removable.**
- **Simple drive design, ruggedly supported by hot-dip galvanized structural members.**
- **Complete line of accessories.**

SEND FOR COMPLIMENTARY COPY OF LOLINE® BULLETIN

Describes many unique design features in detail. Cross-sectional drawings. Photographs of construction features. Capacities. Optional equipment. Write today—on your company letterhead for this bulletin!

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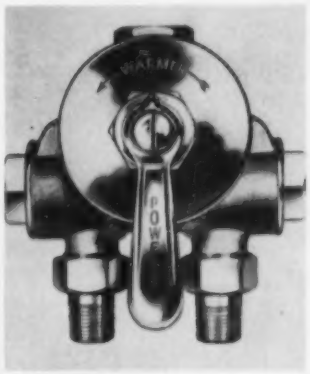
J. F. Pritchard & Co.
OF CALIFORNIA
A DIVISION OF J. F. PRITCHARD & CO.
Dept. 467, 4625 Roanoke Parkway
Kansas City 12, Missouri

COOLING TOWERS * GAS & AIR TREATING EQUIPMENT
REPRESENTATIVES IN PRINCIPAL CITIES FROM COAST TO COAST

EQUIPMENT DEVELOPMENTS

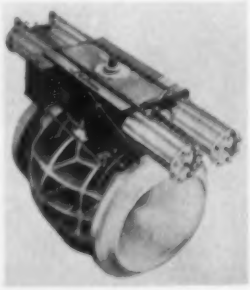
Continued



Mixing Valve . . .

. . . designed to mix cold water, steam to provide hot water at any desired temperature—*Powers Regulator Co., Dept HPAC, 3434 Oakton St., Skokie, Ill.*

"Style D" mixer takes steam and cold water at pressures from 10 to 100 lb; pressure equalizing valve, consisting of a floating piston, controls, equalizes pressure of steam, water before they enter mixing chamber. Available in ½, ¾ in. sizes.



Valve Actuators . . .

. . . engineered to operate high pressure plug and ball valves to 36 in. in size — *Ledeen Mfg. Co., Dept. HPAC, 1600 S. San Pedro St., Los Angeles 15.*

Cited features: balanced torque delivered to valve stem through four-cylinder operation; gas and oil systems separate; no gas-oil interface; for periodic testing, detachable lever permits operation of actuator and controls without turning main valve; easy field installation without modification of plug valve. Available in range of torque capacities, with variety of control systems.

Raypak

Extended Surface, copper tube, gas fired
HOT WATER BOILER of ADVANCED DESIGN

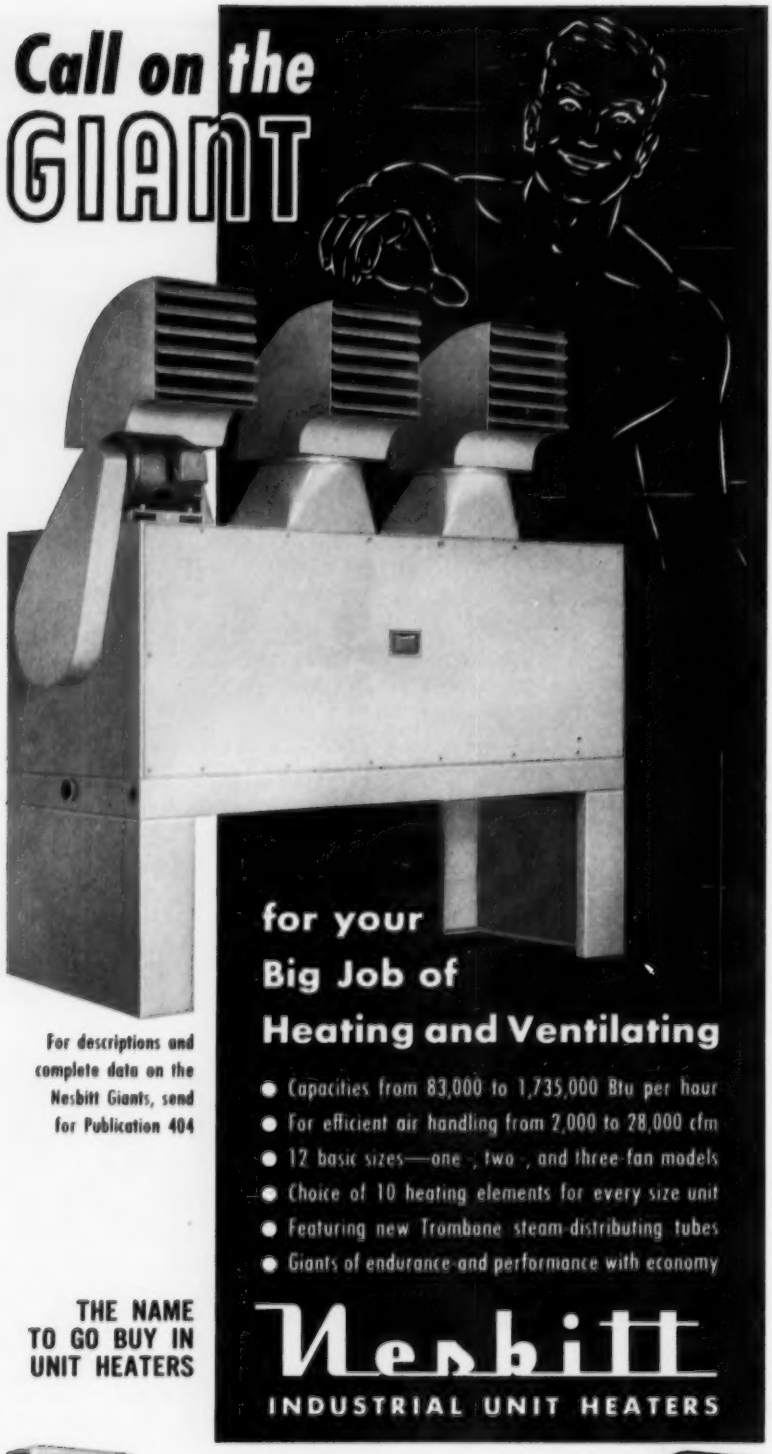
3 times the BTU's per pound of weight
YET FAR STRONGER

Specifically designed for baseboard radiation and radiant panel heating, swimming pools and air conditioning systems. All heating models feature Raypak Gas Modulation, swimming pool models feature self-generating electrical system.

Specify Raypak, the originators of the "Plug-In", package Boiler.

Throughout the country Raypak Company selects specialized and skilled representatives to handle sales and help solve your Boiler problems.

Raypak
RAYPAK COMPANY, INC.
Engineers-Manufacturers
2416 Chico Ave El Monte, California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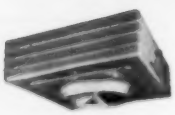
GIANT
for your
Big Job of
Heating and Ventilating
● Capacities from 83,000 to 1,735,000 Btu per hour
● For efficient air handling from 2,000 to 28,000 cfm
● 12 basic sizes—one-, two-, and three-fan models
● Choice of 10 heating elements for every size unit
● Featuring new Trombone steam-distributing tubes
● Giants of endurance and performance with economy
Nesbitt
INDUSTRIAL UNIT HEATERS

For descriptions and complete data on the Nesbitt Giants, send for Publication 404

THE NAME TO GO BUY IN UNIT HEATERS

PROPELLER FAN UNIT HEATERS


LITTLE GIANT UNIT HEATERS

SERIES C UNIT HEATERS

GAS FIRED UNIT HEATERS

Made and sold by John J. Nesbitt, Inc., Philadelphia 36, Pa. Offices in principal cities

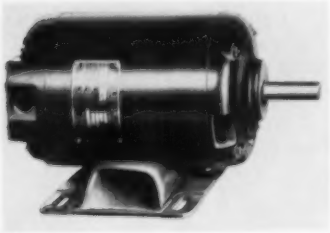
EQUIPMENT DEVELOPMENTS

Continued

Vacuum Gage . . .

. . . in single meter type with range of zero to 100 microns Hg full scale — *Hastings-Raydist, Inc., Dept. HPAC, Hampton, Va.*

With 4 in. indicating meter with knife edge pointer for direct reading on logarithmic mirror meter scale. Half scale on dial face is 15 microns, designed to provide readability for low micron measurements. Unit operates on 115 volts, a-c. Includes internal voltage regulator engineered to eliminate effects from line voltage variations.



Motors . . .

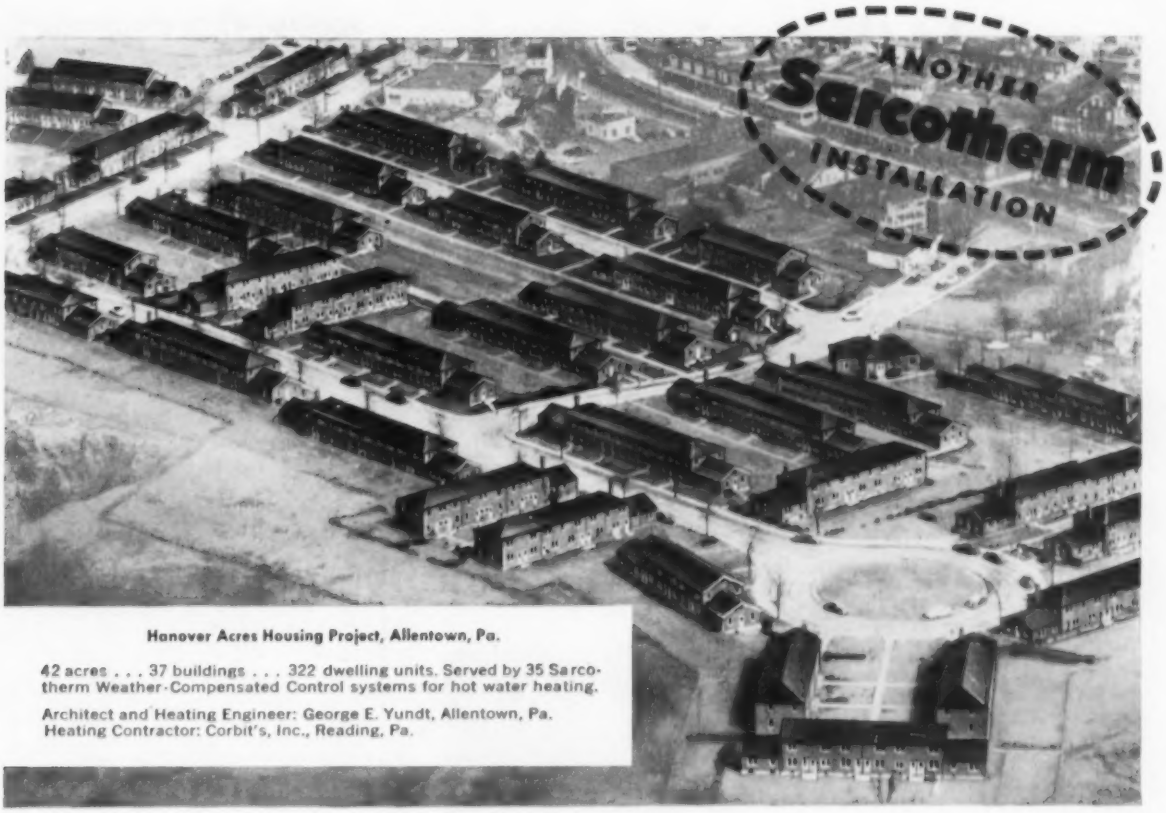
. . . available in new frame series — *Doerr Electric Corp., Dept. HPAC, Cedarburg, Wis.*

Design, called "Frame 566," is combination of lower cost "56" frame components and base designed to give shaft height and location of mounting holes of "66" frame. Oversized bearing on shaft end makes it possible to obtain ¾ in. diameter shaft extension.

Control . . .

. . . for gas water heaters — *Grayson Controls Div., Robertshaw-Fulton Controls Co., Dept. HPAC, Long Beach, Calif.*

Cited feature of "Unitrol 110" is



Hanover Acres Housing Project, Allentown, Pa.

42 acres . . . 37 buildings . . . 322 dwelling units. Served by 35 Sarcotherm Weather-Compensated Control systems for hot water heating.

Architect and Heating Engineer: George E. Yundt, Allentown, Pa.
Heating Contractor: Corbit's, Inc., Reading, Pa.

42 acres of comfortable heating ...for 16 years!

Provided by 35 Sarcotherm Weather-Compensated Control Systems

Here's the Test...35 Sarcotherm Systems...16 years on the job...serving 322 dwelling units at Hanover Acres Housing Project, Allentown, Pa. That's a tough test of heating control dependability and economy!

And here's the Result!...The Housing Authority of the City of Allentown reports...throughout the entire 16 years these Sarcotherm Weather-Compensated Control Systems for hot water heating have given trouble-free service and provided money-saving, comfortable heating.

Dependability-plus...that's one of the major reasons Sarcotherm Systems have been installed in many important projects including Hanover Acres and Beardsley Terrace Housing, Bridgeport, Connecticut.

For undivided responsibility on your installations, specify and order from one "Complete Line" source...SARCO-SARCOTHERM.

Write for catalogs. Sarcotherm Controls, Inc., Empire State Building, New York 1, N. Y.

ADVANTAGES OF SARCOTHERM SYSTEMS

On-the-job help—Sarcotherm engineers cooperate in preparing working drawings and wiring diagrams for each job. Also assist in supervising the installation.

Easy to maintain—simple, trouble-free design, fewer parts.

Easy to adjust—to any desired setting.

Complete Control Systems from Sarcotherm include all accessories such as control panels, thermostats, radiator valves, balancing fittings, steam traps, domestic hot water controls, etc.

4008-B

Sarcotherm

AN AFFILIATE OF SARCO CO., INC.

Weather-Compensated control systems for steam, hot water and radiant heating

When is a ventilating system REALLY modern?

You might say: "Only when a system does a maximum job of heating, cooling or ventilating at least cost." Anything less puts your system behind the times.

The *only* modern method of getting *maximum* heating, cooling or ventilating from a system design is to include air recovery with activated charcoal FilterFolds.

Activated charcoal FilterFolds allow up to 100% recirculation of inside air, eliminating the need of continual heating or cooling of new outside air. At the same time, ventilation is improved as the activated charcoal combs recirculated air clean of smells, stuffiness, smoke, smog and other contaminants.

A system with FilterFolds offers:

1. Savings in first cost of 15-35%. A smaller system, utilizing FilterFolds, does a better job than a larger system without air recovery.

2. Savings in operating cost of 20 to 40% — a strong selling point in any new installation.

3. Maximum ventilating ability. In many localities, smog or other pollutants make outside air unfit for ventilation. FilterFolds put a gas mask on a building — make it independent of outside air for ventilation.

4. Adaptability. Barnebey-Cheney FilterFolds are easy to install in new or existing duct work, any multiples.

The idea of depending on outside air for ventilation is as out-of-date as the horse collar. With activated charcoal air recovery, the *best* air is *inside*.

Your next ventilating job — will it be *really* modern?

Barnebey-Cheney activated charcoal FilterFolds (above) have air purification capacity of 1000 cfm each. Static resistance is a low 0.25" w.g., and efficiency 95 to 99%.

Fold design for maximum surface to air stream. Size of FilterFolds: 24" x 24" x 8¾", or 24" x 12" x 8¾". — 500 cfm. Highest quality charcoal for maximum air cleaning ability.

BARNEBEY-CHENEY COMPANY

world's largest producer of air recovery activated charcoal

WRITE FOR free technical bulletins on Air Purification with Activated Charcoal FILTER-FOLDS

The BARNEBEY-CHENEY Company
Columbus 19, Ohio

My Name _____

Firm _____

Address _____

City _____ State _____

EQUIPMENT DEVELOPMENTS

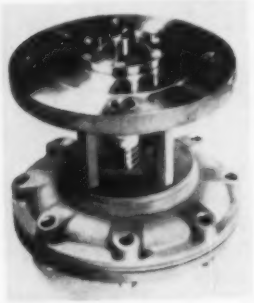
Continued

100 percent shutoff for safety. Magnet assembly, filter cartridge, valve assembly interchangeable with those of other units in company's line. Connections straight-down, parallel.

Time Switch . . .

. . . with seven day dial—*Tork Clock Co., Inc., Dept. HPAC, Mt. Vernon, N. Y.*

Engineered to permit setting of full week's schedule for "automatic" on-off control operations on varied daily program. Recommended by company for control of air conditioning, heating, refrigeration installations in office and industrial buildings, stores, institutions.



Pressure Transmitter . . .

. . . designed to be lightweight, rugged, highly sensitive — *Conoflow Corp., Dept. HPAC,* 2100 *Arch St., Philadelphia* 3.

Operating on force-balance principle, "Model P" unit recommended by company for services involving viscous substances, or materials which solidify in static lines of bourdon tubes. Also has application for liquid level indication on open tanks containing viscous materials or those with solids in suspension. Unit uses flat diaphragms instead of bellows.

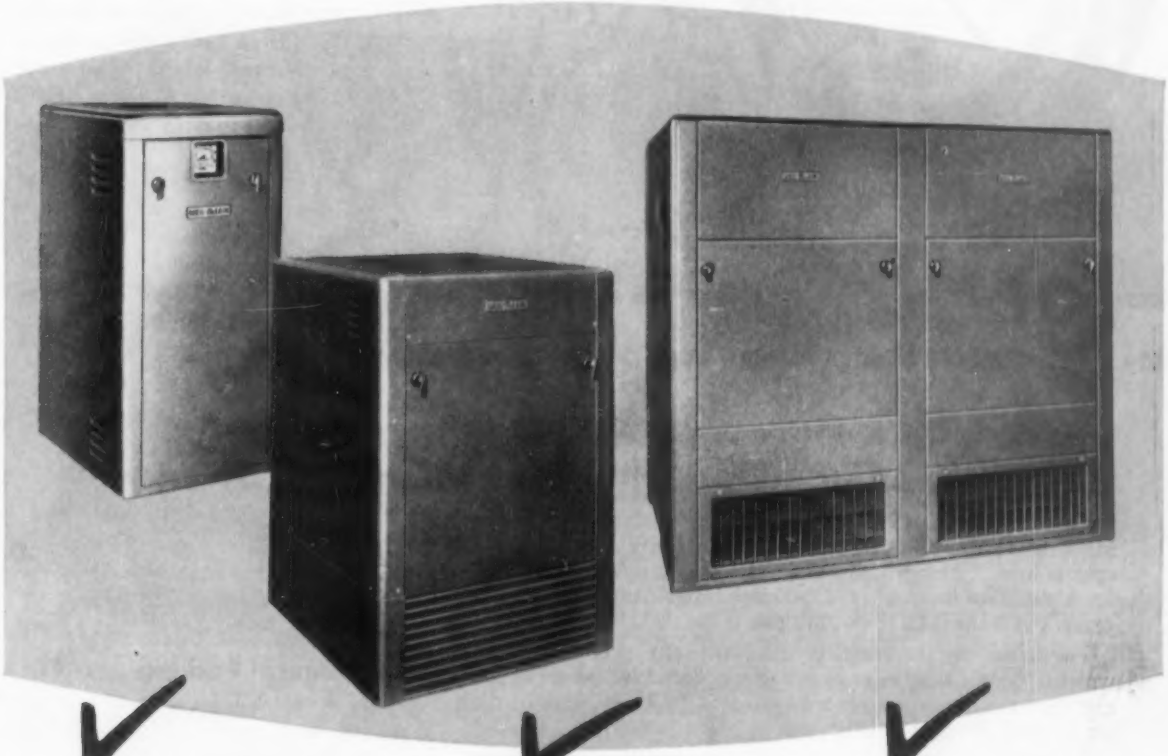
✓ CHECK THE *Extra Values*

IN THIS COMPLETE LINE OF CAST IRON GAS BOILERS

These gas boilers are worth your critical appraisal... you'll find many advanced engineering and efficiency features which explain why it is easier and more profitable to sell Weil-McLain *Extra Values*. In this full line, the reputation of Weil-McLain Boilers for overall efficiency, operating economy and durability is fully sustained.

Weil-McLain Gas Boilers are *cast iron*, to assure long life under the conditions encountered in gas-firing. They burn all gases, including LP. All units are built to ASME Code requirements, approved by AGA and I-B-R rated.

For complete information, send for literature on Weil-McLain *Extra Value* Gas Boilers.



✓ **TYPE G**

For hot water heating systems. A.G.A. input BTU/Hr. from 76,000 to 225,000.

Design highlights: Ribbon-type burners ...individual water-backed, finned flues for balanced gas travel and rapid heat transfer ... factory-assembled controls located high on the boiler...easily cleaned...installs on any type of floor ...delivered with sections and base assembled for quick installation...complete fibre glass insulation.

✓ **TYPE H**

For hot water and steam. A.G.A. input BTU/Hr. from 120,000 to 540,000.

Design highlights: Sections have extra large heating surface, studded for greater heat absorption...large top supply tapping assures easier installation, better circulation and dry steam...provision for high capacity domestic water heater ...dual pilot orifice minimizes "linting" ...short draw-rods simplify erection... completely insulated with fibre glass.

✓ **TYPE J**

For hot water and steam. A.G.A. input BTU/Hr. from 625,000 to 5,000,000.

Design highlights: Large water volume for longer steaming period, high residual heat...extra large flow tappings and nipples assure low steam velocity... quiet, high flame temperature ribbon burner...multiple short draw-rods for simplified erection...removable jacket panels give complete access for easy cleaning...fibre glass insulated.

WEIL-McLAIN

MICHIGAN CITY, INDIANA

WEIL-McLAIN BOILERS · RADIATORS

Address literature requests to Dept. AA-96

RUGGED, DEPENDABLE, ACCURATE

USG GAUGES

for *Every* heating and air conditioning application

The Fig. 500 is typical of the USG gauges used in heating and air conditioning applications.

With its cast iron case, wide bearing areas and movement made of dissimilar metals . . . the entire design is engineered for long service and minimized maintenance. Moreover, the cost is low . . . well below the price that might be expected for a gauge of its quality. Dial sizes range from 4½" to 12"; pressures from 0-15 to 0-1000 psi.

For some applications, contractors may prefer a lighter weight, drawn steel case gauge of the Fig. 500S series. These are also available for pressures up to 1000 psi, but in dial sizes from 2" to 4½".

Whether you buy as a contractor, or specify as an engineer, you'll be certain of quality and performance with USG gauges. As a manufacturer, buying gauges to be sold as a component of your heating or air conditioning equipment, you'll find it advantageous to do as 6 of 10 such manufacturers do . . . specify USG.

Your USG distributor has in stock, or can get for you, any quantity of any of the 50,000 gauges made by USG for all types of installations.

Write us for the name of the distributor in your area.

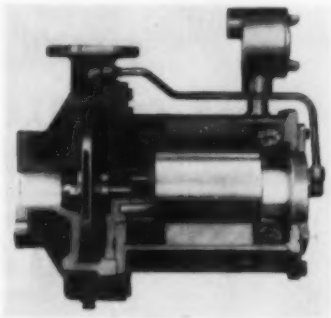
UNITED STATES GAUGE

Division of American Machine and Metals, Inc.
Sellersville, Pa.

Home of the **SUPERGAUGE**

EQUIPMENT DEVELOPMENTS

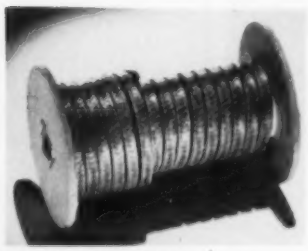
Continued



Centrifugal Pump . . .

. . . engineered for leakproof handling of fluorinated hydrocarbon refrigerants, ammonia, brine, chilled water — *Chempump Corp., Dept. HPAC, 1300 E. Mermaid Ln., Philadelphia* 18.

Seals, stuffing box eliminated. Design combines pump, motor in single hermetic unit. Pumped fluid enters motor section, provides bearing lubrication. Liner isolates motor windings. Heads range to 195 ft, capacities to 250 gpm.



Chemical Packing . . .

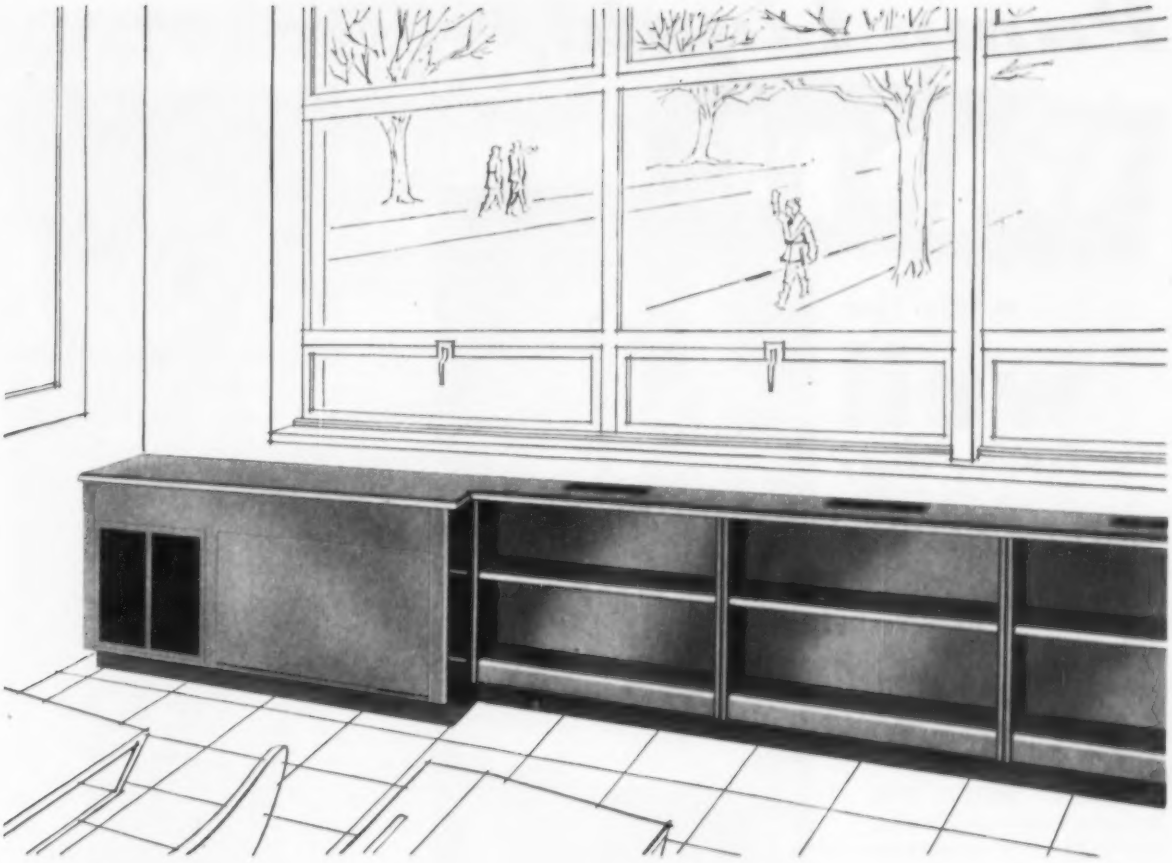
. . . formulated for greater corrosive resistance, service life — *Abbott & Biddle Co., Dept. HPAC, 2417 Federal St., Philadelphia* 46.

Packing is braid over braid of glass and teflon. Is said to provide low friction packing for use on centrifugal, reciprocating, static applications. Gives good performance under wide temperature, chemical exposure conditions, says company.

Leak Test Fittings . . .

. . . for testing fabricated tubing — *Chicago Forging & Mfg. Co., Dept. HPAC, 2000 Southport Ave., Chicago* 14.

"Sealastic" offers quick, easy finger tightening, disconnecting, says



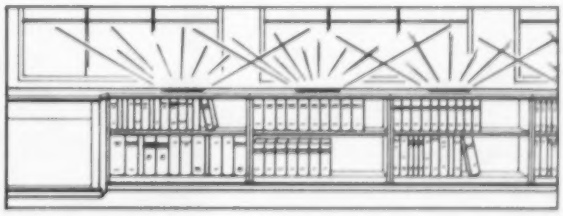
Now you can plan economical classroom comfort with the Norman Schoolroom System

gas-fired forced air heating and ventilating with Util-i-Ducts

The Norman Classroom Package helps keep school construction costs down. It is a completely automatic gas-fired forced air perimeter heating and ventilating system which eliminates the extra cost and space required for a central heating plant. Each room has its own individual heating and ventilating system. Any number of additional classrooms can be added later without expensive revamping as required with a central heating plant.

The exclusive Norman Schoolroom System automatically filters and mixes outdoor air and room air to maintain a healthful and comfortable climate. It automatically compensates for variations in the heating and ventilating requirements caused by changes in occupancy and outside weather conditions. Outside air only is used for combustion.

Util-i-Duct sections are designed to blanket the outside walls with controlled tempered air and also provide handy bookshelf space. Each section has an individual diffuser with damper and adjustable louvers for accurate balancing and uniform distribution. Sections can be extended around the outside walls and under windows — available in standard length sections, corner units and adjustable filler sections to flush in with wall partitions.



Util-i-Duct sections assure proper air distribution for complete classroom comfort and provide bookshelf space.

Norman® products company

Mail the coupon today for full details and specifications

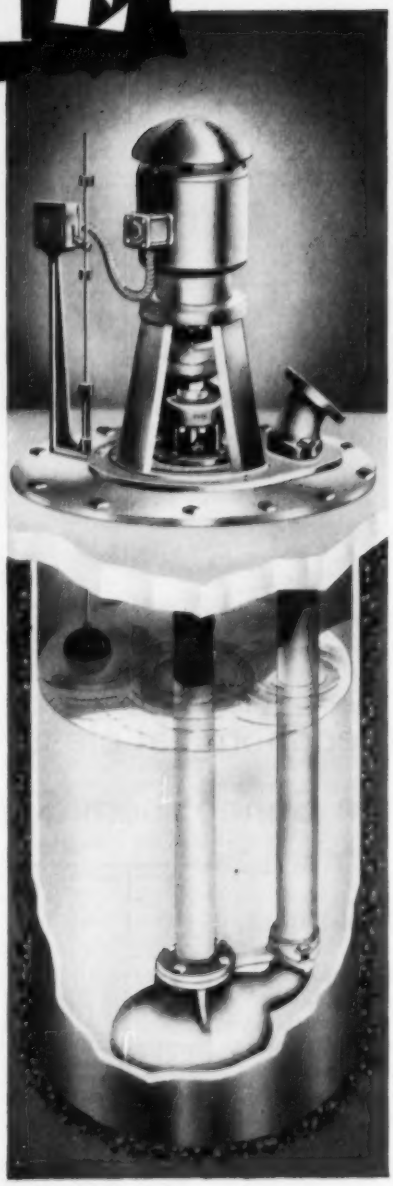
NORMAN PRODUCTS CO.
1156 Chesapeake Ave., Columbus 12, Ohio
Please send me complete information on the Norman gas-fired, forced air Schoolroom Heating and Ventilating System.

NAME _____

ADDRESS _____

CITY _____ STATE _____

Pump Liquid WASTE with the weil Heavy duty Sewage Ejector



The Weil screenless sewage ejector with the NON-CLOG impeller effectively handles large diameter solids, rags and stringy material of various lengths which are washed into the sewage pit.

RUGGEDLY BUILT: This factory assembled unit has an ample reserve of strength to meet the most severe conditions and furnish years of trouble free operation.

SIMPLIFIED PIPING: Only one piping connection required. An economical installation.

NON-CLOG: Wide waterways of pump casing permits unobstructed passage of maximum solids handled by the non-clog impeller.

Sizes available for all normal industrial and building needs.

Send for new bulletin C900E with complete engineering data and performance tables.

Weil Representatives and Weil Engineers are available to help solve your waste pumping problems.

weil PUMP CO.

1514 No. Fremont St. **Chicago 22, Illinois**

EQUIPMENT DEVELOPMENTS
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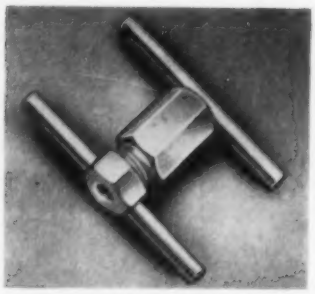
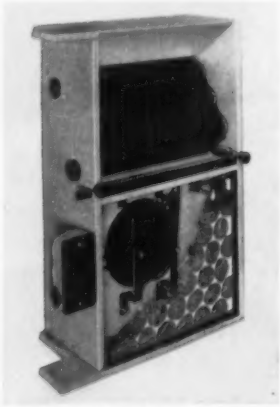


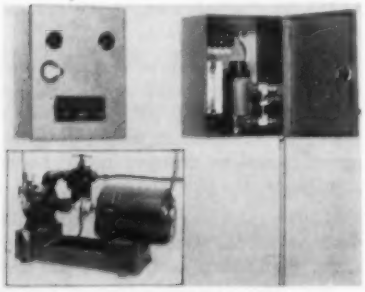
company, provides leakproof joint. Is said to simplify leak testing condensers, compressors, etc. In standard sizes 3/16 to ½ in. Construction employs renewable synthetic rubber seal ring.



Heating, Cooling Unit . . .

. . . with heat rating of 11,000 Btu, cooling rating of 4300 Btu—*Ejay Baseboard Mfg. Co., Dept. HPAC, 124 Boyd St., Winsted, Conn.*

Features completely insulated, nonmetallic box. Model "No. 100" available in either recessed, free-standing models.



Combustible Gas Alarm . . .

. . . for guard against explosions in areas of extreme temperature, in-

PROOF that SIL-FOS brazing assures long-lasting water-tight joints

For some time now the RHEEM Manufacturing Co. have been using a SIL-FOS low-temperature silver brazing alloy in making a vital part of their revolutionary COPPERMATIC domestic water heaters — *the inner tank of pure copper.* This large tank is made of two identical halves brazed with SIL-FOS 5. The finished tanks are one of the reasons why RHEEM unhesitatingly gives a 10-year warranty on COPPERMATICS.

SIL-FOS brazing is fast!

At rear, the copper halves—each with a ⅜" turned-in flange around its edge—are accurately held in a jig and tack-brazed. Then the seam is completed as shown in foreground. Brazing per seam is 80". Two men do it in 1 minute. Inner and outer tank assemblies are hydrostatically pressure-proved at 300 lb. per sq. in.

GET THE CONVINCING SIL-FOS FACTS IN BULLETIN 20

It tells you why SIL-FOS joints are as strong, rust-proof and long-lasting as the non-ferrous metals joined—and why SIL-FOS brazing is so fast and economical. Write for a copy today. With it we'll send a list of SIL-FOS Distributors. There's one near you ready to render helpful service.

HANDY & HARMAN
FOUNDED 1867
QUALITY + SERVICE
ORIGINATORS OF EASY-FLO & SIL-FOS

HANDY & HARMAN

General Offices: 82 Fulton St., New York 38, N. Y.

DISTRIBUTORS IN PRINCIPAL CITIES

OFFICES and PLANTS
BRIDGEPORT, CONN.
PROVIDENCE, R. I.
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LOS ANGELES, CALIF.
TORONTO, CANADA
MONTREAL, CANADA

❶ Proven, Westinghouse-manufactured, extended surface heating coils good for continuous operation up to 200 psig.

❷ Die-formed casings with rounded corners eliminate accidents and dirt catching pockets. Front and back panels easily removable.

❸ Multiple louvered outlets for efficient distribution of heated air.

❹ Self-aligning, grease-lubricated ball bearings mounted outside casing readily serviceable.

❺ Face and by-pass dampers permit continuous air circulation to maintain uniform temperatures.

NOTE: Louver-type mixing box accessory permits introduction of fresh air for make-up and ventilation, with or without filters.

Westinghouse...The Unit Heater for General Purpose and Heavy Duty Industrial Heating

★ These rugged units available in 24 sizes, 8 coil selections, 150 ratings—from 100,000 to 2,500,000 BTU/hr., capacities from 2000 to 25,000 CFM each.

★ GENERAL PURPOSE HEATER . . . For manufacturing areas, warehouses, garages, commercial buildings —with standard non-ferrous heating coils.

★ HEAVY-DUTY HEATER . . . For continuous-duty high-pressure systems, or industrial process work — with wrought iron heating coils.

★ FOR APPLICATION SERVICE . . . Call your nearest Sturtevant Sales Engineer or write Westinghouse Electric Corporation, Dept. 14J. Hyde Park, Boston 36, Mass. . . . ask for Booklet B-5188.

Industry's Most Complete Line For:

Heating & Ventilating — *Cooling & Dehumidifying*
Industrial Processes — *Electronic Air Cleaning*

WATCH WESTINGHOUSE!

COVER PRESIDENTIAL CAMPAIGNS ON CBS TELEVISION AND RADIO

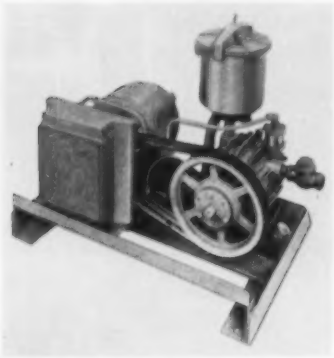
J-80451A

EQUIPMENT DEVELOPMENTS

Continued

accessible locations — *Johnson-Williams, Inc., Dept. HPAC, 2715 Park Blvd., Palo Alto, Calif.*

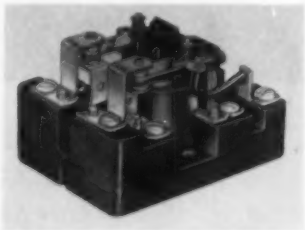
Sensitive, flashback-protected filament in sample drawing accessory reacts to combustible gas in sample flow. Model "E" available with sample drawing accessory with flow meter, flow adjusting valve.



Vacuum Pumps . . .

. . . with radiator coo'ed lubricating system — *Leiman Bros., Inc., Dept. HPAC, 102 Christie St., Newark 5.*

In two models engineered to produce vacuums of 24 to 29.9 in. Hg. with capacities 15 to 40.8 cfm. For continuous operation at average temperatures of 110 F. Low operating temperature maintained by circulating precooled SAE 30 lubricating oil through pump, says company. Constant recirculation of oil is said to maintain constant low temperature.



25 Amp Power Relay . . .

. . . designed for heavy duty service — *Guardian Electric Mfg. Co., Dept. HPAC, 1621 W. Walnut St., Chicago 12.*

Unit engineered to meet space limitation of equipment now using larger power controls. Cited applications include motor starting, heater

INSTALLING CONTRACTOR: O. A. WENDT COMPANY, CHICAGO

1300 FEET of trench were needed, without special preparation or forms. Note simple concrete supports—no anchors are evident.

EXPANSION LOOP demands only additional GILSULATE on one side of each loop leg in the direction of expansion.

Midwest manufacturer chooses GILSULATE® for plant expansion program

New underground steam lines protected with Triple-Zone insulation system

When one of the world's largest manufacturers of heavy-duty engines expanded plant facilities, the company chose GILSULATE to insulate and protect their hot underground piping system. They knew that GILSULATE gives maximum insulation and corrosion protection against commonly-encountered underground conditions. And they knew too that GILSULATE's low cost for the *complete* installation could not be matched by any other underground pipe insulation.

This typical GILSULATE installation runs for 1300 feet from the plant's main boiler room to the new parts building. Included in the system are a 14-inch steam line, an 8-inch steam line, and a 6-inch condensate return. The line carries 150 pounds of steam pressure with superheat.

Your local GILSULATE distributor will be glad to show you all of the advantages of the modern, efficient GILSULATE Insulation System. Complete details are yours for the asking. Write the office nearest you today.

GILSULATE IS POURED AND TAMPED easily and quickly. Leap frog sheet metal forms conserve material; bulldozer handles backfill.

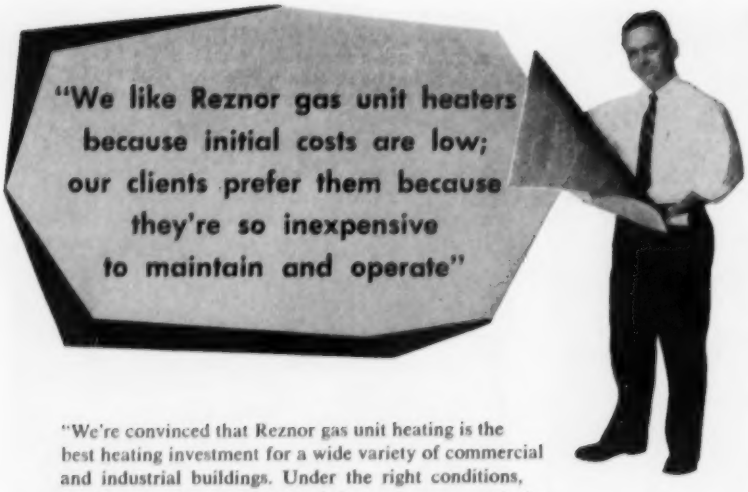
Facts about Gilsulate

1. **EASY TO USE**—just pour and tamp... pipe heat does the rest.
2. **FORMS 3 ZONES** of protection against heat loss and all hazards commonly encountered by hot buried pipes.
3. **NEEDS NO HOUSING OR MECHANICAL SHEATHS**: no mixing, special handling or equipment.
4. **ONLY NEEDS NORMAL PIPE SPACING**: for multiple pipe or cramped conditions.
5. **THREE TYPES AVAILABLE**:
   Type A for 220°-300°F. temp. range
   Type B for 300°-385°F. temp. range
   Type C for 385°-520°F. temp. range

THE TRIPLE-ZONE INSULATION SYSTEM FOR LIFE-TIME PROTECTION OF HOT UNDERGROUND PIPES

GILSULATE®

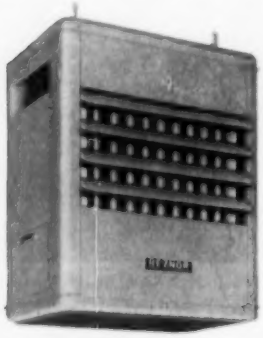
AMERICAN GILSONITE COMPANY, SALT LAKE CITY 1, UTAH
Affiliate of Barber Oil Corp. & Standard Oil Co. of California
OFFICES AT: 134-B West Broadway, Salt Lake City, Utah
1145 East Jersey Street, Elizabeth 4, New Jersey
The Agents Building, 3537 Lee Road, Cleveland, Ohio


"We like Reznor gas unit heaters because initial costs are low; our clients prefer them because they're so inexpensive to maintain and operate"

"We're convinced that Reznor gas unit heating is the best heating investment for a wide variety of commercial and industrial buildings. Under the right conditions, no other system can approach it for performance. Under any conditions no other system can approach it for economy.

"We found that the cost of the necessary Reznor gas unit heaters compares very favorably with the cost of any other type of heating equipment of the same total capacity. And with Reznor, the equipment cost is total cost. There are no registers or radiators, no expensive piping or duct work to buy. That means real savings on installation cost, too. To install a Reznor gas unit heater you just suspend it, make simple gas, electrical and vent connections and move on to the next one. That's real economy . . . it helps stretch budgets.

"Our clients like Reznor heaters for other reasons, too. Reznor heaters not only save money in the beginning, they keep on saving year after year. Reznor heat is instant heat . . . there's no need for costly stand-by firing. With on-the-spot Reznor heat, there's no heat lost in transmission. And with each Reznor heater operating independently, there's no need to heat areas which aren't in use. All this adds up to substantial savings on fuel. Reznor heaters require no operating labor. And maintenance costs are practically zero. All Reznor heaters require is a simple cleaning once a year. It's no wonder that our clients who have tried it once want Reznor heating in their next building."



Remember, there is no equivalent for Reznor gas unit heaters. Be sure you have complete information on these fine heaters at your fingertips. Write today for your free catalog or call your nearby Reznor distributor. You'll find him listed under "Heaters-Unit" in the yellow pages of your telephone directory.

REZNOR
THE WORLD'S LARGEST-SELLING GAS UNIT **HEATERS**
REZNOR MANUFACTURING COMPANY
51 Union Street, Mercer, Pa.

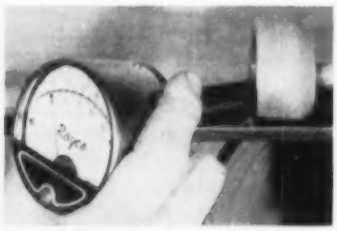
EQUIPMENT DEVELOPMENTS
Continued

loads, heavy industry control systems. "Interchangeable coil" feature facilitates changing coil of same or different value ranging 6 to 230 volts, a-c.

Time Delay Valves . . .

. . . in two-, three-, four-way models — *Airmatic Valve, Inc., Dept. HPAC, 7317 Associate Ave., Cleveland 9.*

Are said to provide delayed actuation with immediate reversal or immediate actuation and delayed reversal. Pilot operated. May be remotely located, controlled from central station. In ¼, ⅜, ½, ¾ in. sizes.



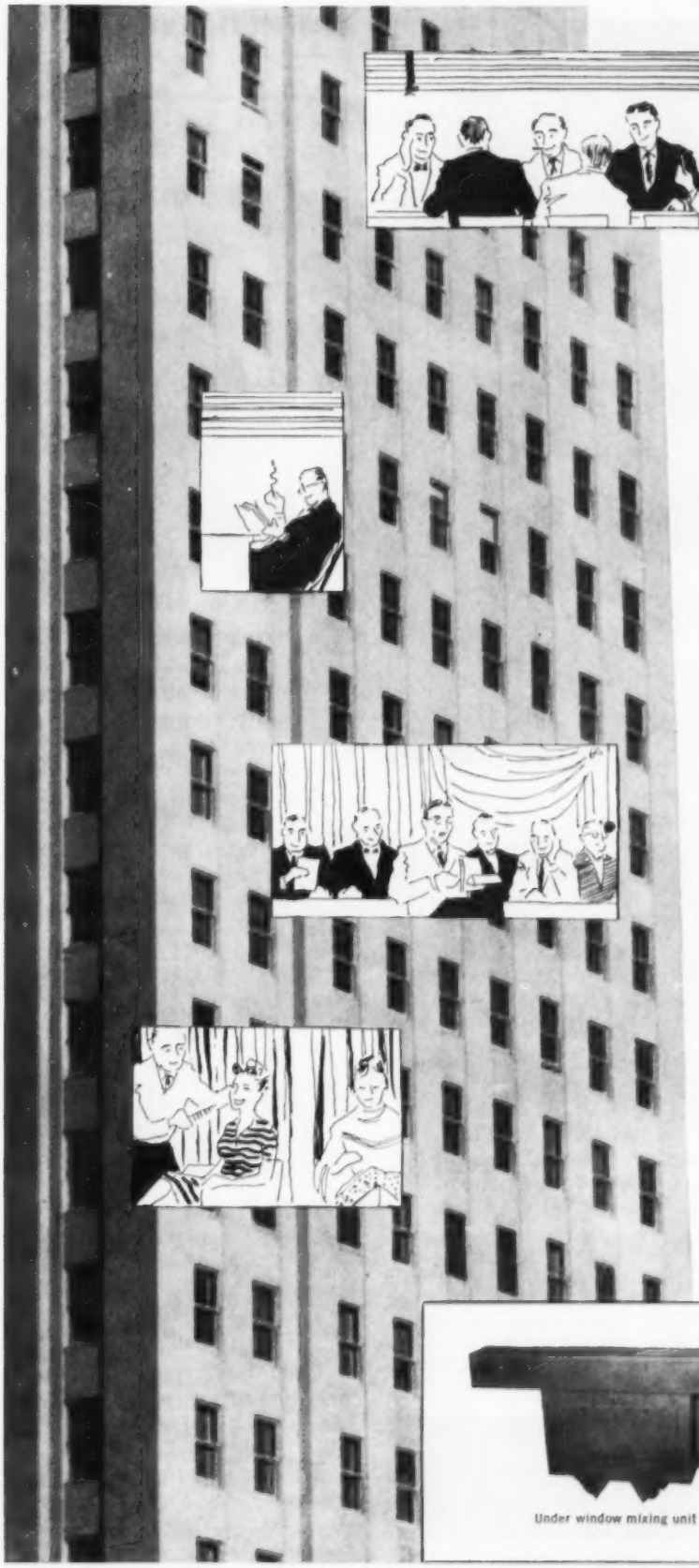
Thermometer . . .

. . . designed to indicate surface temperatures on a 1 second contact— *Royco Instruments, Dept. HPAC, 797 Arthur St., Albany, Calif.*

Unit combines surface-contact thermocouple, indicating meter damped for quick reading, shock resistance, pointer stability. Waterproof construction permits use in wide range of fluids. Stainless-steel probe scale calibrated over 0 to 650 F, available 0 to 1000 F.

Fluid Cooler . . .

. . . equipment for applications requiring heat dissipation of 1 to 100 kw — *Trane Co., Dept. HPAC, La Crosse, Wis.*



Select the temperature room by room... it stays constant automatically

Buensod-Stacey DUAL DUCT air mixing units are the reason

The mixing unit is the heart of the dual duct method of air conditioning. The Buensod-Stacey dual duct mixing unit differs from all others in its self-contained volume control.

This control is completely automatic and requires no outside connections or source of power. It will maintain the volume of warm and cool air entering a given room regardless of variations in pressure at the inlet of the unit.

When thermostatically controlled, Buensod-Stacey air mixing units maintain steady room conditions even when outside temperatures vary as much as 40° in one day! You can heat one room and cool the one next to it . . . allow 100 people in one room to be as comfortable as the two in the room next door (just as the varying spaces illustrated at the left are conditioned by *one* system). And the system needs no costly seasonal changeover.

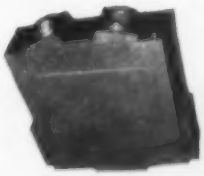
Buensod-Stacey dual duct units contain no coils, fans, filters, electric motors or water piping. This means there is virtually no service or maintenance for the units — no possibility of leaks or corrosion in scattered areas throughout the building. Buensod-Stacey equipment is available for large or small, existing or new buildings.

For full information write:

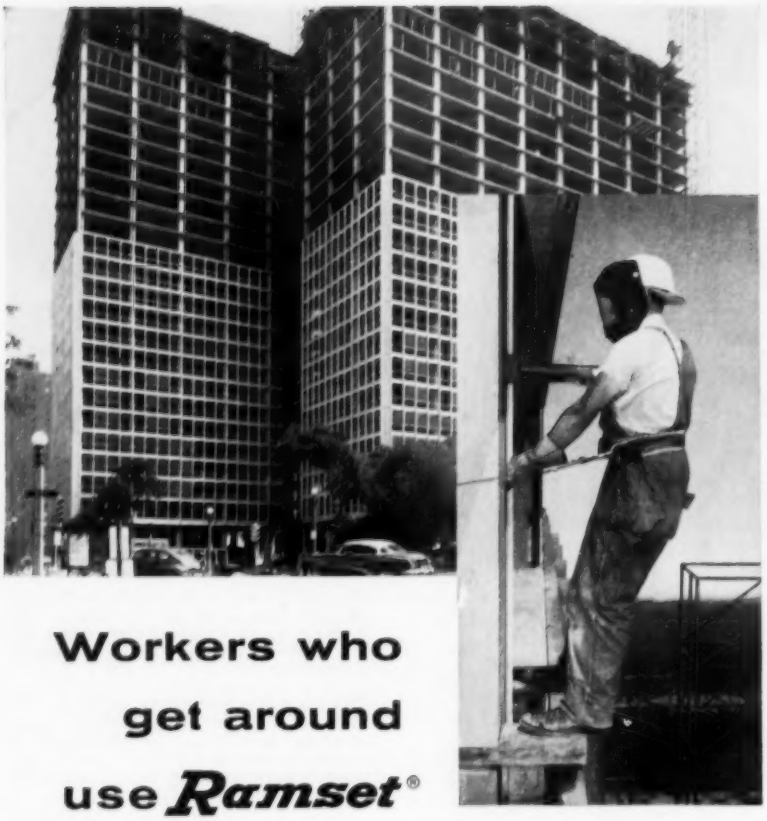
BUENSOD-STACEY
INCORPORATED

45 West 18th Street • New York 11, N. Y.

Under window mixing unit



Air mixing unit for overhead installation



Workers who get around use *Ramset*®

Unhampered by hose, wires or other cumbersome equipment, workers using RAMSET can move anywhere . . . fasten anything securely to concrete or steel just by squeezing a trigger!

RAMSET is powder-actuated. Operator carries the power in his pocket. One-hand operation makes it easy on ladders, scaffolds, other awkward places.

DUO-JOBMASTER® sets the standard for the industry. It is two tools in one, sets ¼″ or ⅜″ fasteners with the same tool, merely by switching barrels.

The DUO-JOBMASTER is a powerful, full-sized working tool developed from 10 years' experience. This one tool will do 90% of your fastening jobs!

For fastening anything to hard materials, RAMSET FASTENING SYSTEMS can save you time, money, effort. Your FREE catalogs await you. Ask for *both* RAMSET and SHURE-SET. Write today:

Shure-Set TRADEMARK
companion to *Ramset*

This hammer-in tool for cinder block and masonry uses no cartridge; just makes hammer-power more effective. When nails fail and RAMSET is more powerful than needed, use SHURE-SET!

Ramset Fastening System
WINCHESTER-WESTERN DIVISION
OLIN MATHIESON CHEMICAL CORPORATION

12109-I BEREA ROAD • CLEVELAND 11, OHIO

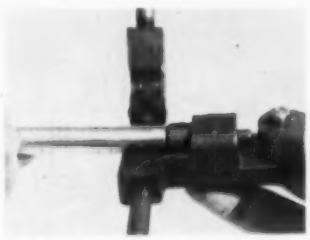
EQUIPMENT DEVELOPMENTS
Continued

For radio, radar, television vacuum tube cooling. Components of equipment, which use ambient air as cooling medium, are: extended surface cooling coil, centrifugal or propeller fan, high pressure circulating pump, safety controls.

Diaphragm Pump . . .

. . . for water laden with mud, sludge, other foreign bodies that clog action of ordinary centrifugal pumps — *Gen-A-Matic Corp., Dept. HPAC, 14741 Bessemer St., Van Nuys, Calif.*

For suction lifts to 25 ft. Cited features: long life diaphragm, non-clogging valves, use of antifriction bearings in pump rod and in main transmission. Powered with gasoline engine. Capacity is 6000 gph.



Flaring Tool . . .

. . . designed to produce "perfect" flare in end of copper tubing "in 10 seconds" — *William L. Engesser & Co., Dept. HPAC, 9745 E. Rush St., El Monte, Calif.*

"Spe-D-Flar" operates as follows, says company: open unit and place copper tubing against flaring pin; close holding jaws and hold handles firmly together; close compression cam handle which moves flaring pin against copper tubing. Available in sizes ¼, 5/16, ⅜, 7/16, ½ in.

Repeat orders prove—

*What they say:**

"No maintenance cost"
11 stokers

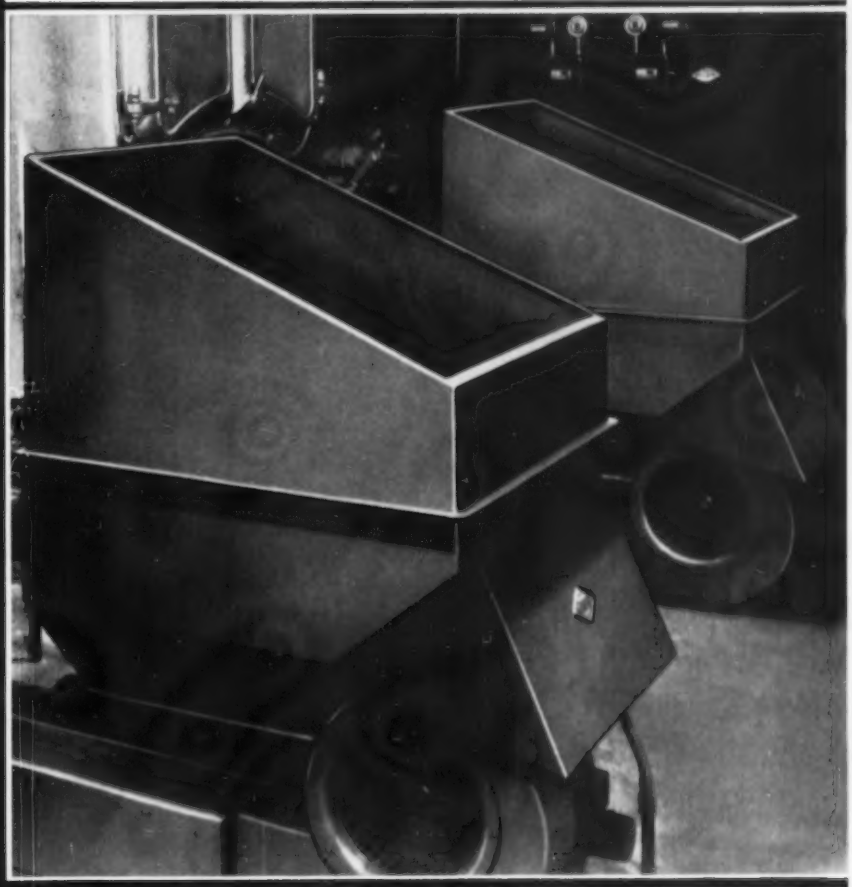
"controlled heat without waste"
30 stokers

"convinced we made wise decision"
20 stokers

"recommend for trouble-free service"
72 stokers

"after rigid usage, found very satisfactory"
15 stokers

**Owner's name available*



WILL-BURT'S BEST

NOT JUST ANOTHER STOKER...

but a proven way to years of comfort with clean, safe, economical heat

Repeat orders *are* the proof! Even without praise such as is contained in the brief quotes above*, when purchasers come back again and again, a manufacturer *knows* his product is doing the job.

That's been the case with Will-Burt Stokers for some twenty-seven years. Orders and re-orders continue to come in from people we've dealt with for years—proving that Will-Burt Stokers *do* provide the greatest heating efficiency with the greatest economy and the least maintenance.

Will-Burt Stokers have always been manufactured by the same people, in the same place . . . more every year . . . *proof* that if you need service, you will know where to get it. If you do not know about Will-Burt features, it will pay you to get the facts. Ask us—and ask your architects and engineers. (It pays to have their advice.)

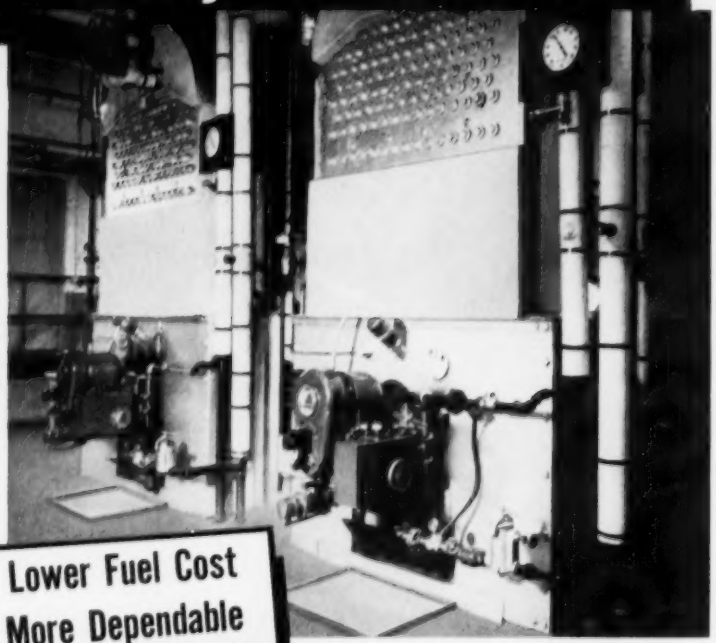
Write for complete Reference Manual, AIA File No. 30-G-3, valuable for architects, engineers, contractors, and specifying authorities. Ask also for brochure, "The Logic of Stoker Heating."

The WILL-BURT Company

OUR TWENTY-SEVENTH YEAR IN THE STOKER BUSINESS

P.O. BOX 902, ORRVILLE, OHIO

Why It PAYS to Install PREFERRED *Rotary* Heavy-Oil Burners



Lower Fuel Cost
More Dependable Automatic Operation
Less Maintenance

Preferred Burners firing #6 oil into two water tube boilers, each 20,000 lbs. steam capacity, at Henry Barnard School, New Rochelle, N. Y.

Whether in converting coal-fired boilers or for inclusion in modern, automatic, oil- or gas-fired boilers, Preferred Horizontal Rotary Burners have established an enviable record of dependable, economical performance.

A case in point is the boiler room shown here where by the adaptation of existing combustion systems and the application of Preferred Oil Burners and automatic control, two old coal-fired boilers were brought up to modern heating standards.

In the four years since conversion there have been no emergency shutdowns. Oil firing with Preferred Burners has resulted in:

1—Raising combustion efficiency from 62 to 81 per cent.
2—Reduction in fuel cost by 26.5 per cent.
3—Practically automatic operation and elimination of manual labor.
4—A boiler room as clean as the classrooms.

This is literally true of thousands of Preferred Burner installations in commercial, industrial and institutional establishments. Learn how it pays to get better heating results with Preferred. Write for Bulletin 175.

PREFERRED UTILITIES MFG. CORP.
1860 BROADWAY NEW YORK 23, N. Y.

EQUIPMENT DEVELOPMENTS
Continued

Valve . . .

. . . for pressure reducing, regulating — *A. W. Cash Co., Dept. HPAC, P. O. Box* 551, *Decatur, Ill.*

"Type 3381" engineered small in size. Designed for pressure control of air, water, oil, steam — most liquids, gases. Sizes are ¼ and ⅜ in. with screwed ends. For operation at inlet pressures to 400 psi at 150 F, 250 psi at 400 F. Fire spring ranges available 5 to 300 psi delivery pressure.

Stud Driver . . .

. . . for hammer powered use — *Hilti Rapid Fastening Systems, Inc., Dept. HPAC,* 55 *Vandam St., New York.*

Alloy studs and pins rustproofed. Only three or four hammer strokes necessary to anchor fasteners into materials such as solid concrete, brick, cement, masonry, etc., also steel to 5/16 in., says company.

Vacuum Cleaners . . .

. . . with stainless steel tanks — *Premier Co., Dept. HPAC,* 755 *Woodlawn Ave., St. Paul* 1.

Units of this type previously available only on special order. "PS-901" vacuum cleaner has stainless tank. "P-909" model displays new blue, red,

4 PACE-SETTERS by *Burnham*

PACE-PAK®

For maximum performance with minimum servicing, choose this preassembled and packaged oil boiler. Boiler, controls and wiring are factory installed and factory tested. Delivered in sturdy crate for easy installation.

HOLIDAY

This extra-efficient advanced-design gas boiler brings new economy to gas. Here's maximum comfort for the modern home. Also available as packaged Holiday-Pak. Boiler, controls and wiring factory installed and tested. AGA approved.

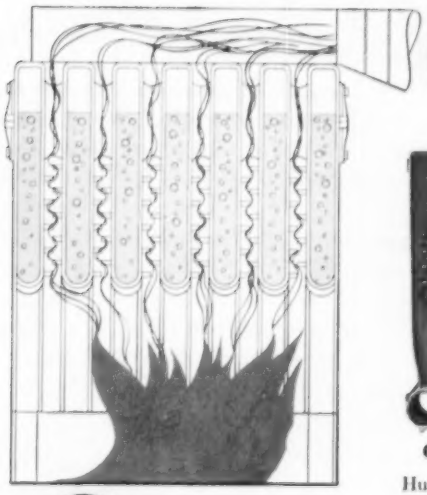
PACEMAKER®

Designed exclusively for oil. High operating efficiency, insures more heat, quicker heat, clean heat and at lower fuel cost. Its high repeat sales prove it a solid hit with home-builder and heating contractor alike!

PACE-KING®

For apartments, schools, hospitals and commercial installations. An advanced design . . . engineered for automatic firing. Available in 14 sizes. Ratings from 1,100 to 4,500 sq. ft., steam. 1,925 to 7,200 sq. ft., water. Can be fired from front or rear.

4 pace-setting features that make sales for YOU!



1 **VERTICAL FLUE TRAVEL**

Illustration shows how this design gets the most out of the fuel. Low draft losses because of balanced flueway design — each section with its own outlet to smokehood.

2

GREATER HEAT ABSORPTION

Hundreds of heat grabbing fins on each section emphasize the tremendous heat absorbing qualities of these boilers. Also there are no baffles to become burned out or loose. Special construction eliminates any need for them.

3

TANKLESS HOT WATER HEATERS

Any of these boilers can be equipped with specially designed and built-in, all copper coils for automatic year 'round domestic hot water. Capacities from 3 to 15 gallons per minute.

4 **BURNHAM BOILERS**

wear like iron because they're made of iron. They'll give you a lifetime of trouble-free service.

Burnham Corporation

FIRST IN THE MANUFACTURE OF BASEBOARD HEATING

IRVINGTON • NEW YORK

Burnham Corporation HP-96
Irvington, New York

Please send illustrated folders giving full data on:
☐ PACE-PAK ☐ HOLIDAY ☐ PACEMAKER ☐ PACE-KING

Name .....

Address .....

City ..... State .....

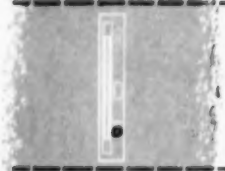
Which of these
NEW PETROMETER
Liquid Depth Gauges

best suits your installation?

You can obtain new Petrometer Series 1400 Remote Reading Tank Gauges in 4 Models to suit almost every industrial installation. All gauges operate on the sound principle of hydrostatic pressure . . . no moving parts or intricate mechanisms to cause failure through wear, corrosion or friction. Large, vertical scale gives accurate, easy-to-see readings.

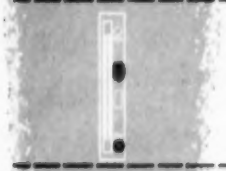
Gauges can be installed on tanks above or below the ground and up to ¼ of a mile away.

CHOOSE FROM THESE 4 MODELS



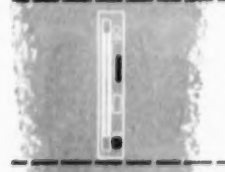
MODEL 1400 A

Equipped with aerating valve for semi-automatic purging of the transmission line. Purging line attaches to compressed air line.



MODEL 1400 B

Equipped with Bubbler as well as aerating valve. Transparent Bubbler provides a constant visual check on aeration. Used with compressed air source.



MODEL 1400 F

Equipped with Flowmeter and aerating valve. Actual rate of flow of air for purging can be preset and indicated on the Flowmeter. Requires compressed air supply.

MODEL 1400 M

For use where compressed air source is unavailable. Equipped with Manual Air Compressor and Aerating Valve.

Petrometer Gauges can be obtained in multiple units incorporated on a single panel and mounting plate to meet your specifications. High-level — low-level alarms also available.

For complete information, send for Bulletin 6004.

Petrometer CORPORATION

43-22 TENTH STREET, LONG ISLAND CITY 1, N.Y.

EQUIPMENT DEVELOPMENTS

Continued

gray industrial enamel finish replacing solid gray paint previously used on standard steel models.

Equipment Briefs . . .

PRESSURE SENSITIVE TAPE designed to resist action of many reactive chemicals, drastic temperature changes—*Minnesota Mining and Mfg. Co., Dept. HPAC,* 900 *Fauquier St., St. Paul* 6. "Scotch" brand "Teflon" (polytetrafluoroethylene resin) tape No. 549 is quickly, easily installed to wide variety of surfaces, says company.

IRON POWDER ELECTRODE for a-c or d-c operation in all positions—*Hobart Bros. Co., Dept. HPAC, Troy, Ohio.* Iron powder in coating is said to permit welding at higher currents to increase deposition rates over conventional type electrodes. In 1/8, 5/32, 3/16, 7/32, 1/4, 5/16 in. sizes.

FILTER combining cotton packing for removal of micro-organisms from a gas with porous stainless steel filter element designed to prevent contamination by lint fibers—*Micro Metallic Corp., Dept. HPAC,* 30 *Sea Cliff Ave., Glen Cove, N. Y.* For use in pharmaceutical operations requiring sterile techniques.

IMMERSION HEATER with built-in control—*N. J. Thermex Co., Inc., Dept. HPAC,* 533 *Bergen St., Harrison, N. J.* Single unit heater-thermostat recommended by company for use in small plating tanks, independent series in large tank installations.

WHITEPRINTING MACHINES designed to expose, develop ammonia type whiteprints up to 32 fpm—*C. F. Pease Co., Dept. HPAC,* 3901 *N. Rockwell St., Chicago* 18. Twin table units available in "Champion," "Spartan" models for one-step, two-step feed operations, respectively. ≠

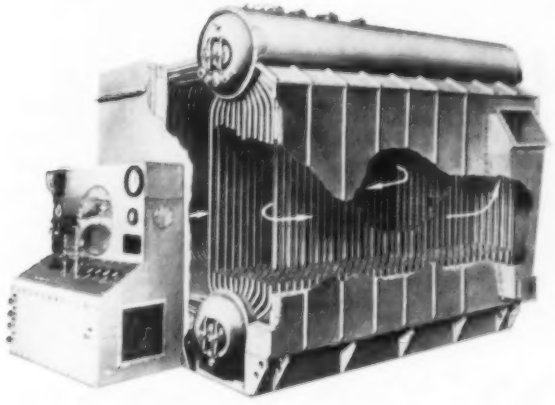
FOR STEAM CAPACITY up to 60,000 POUNDS

Choose your boiler from these two

If you burn oil or gas, investigate the VP Package Boiler for capacities up to 40,000 pounds per hr . . . the VU-10 up to 60,000 pounds.

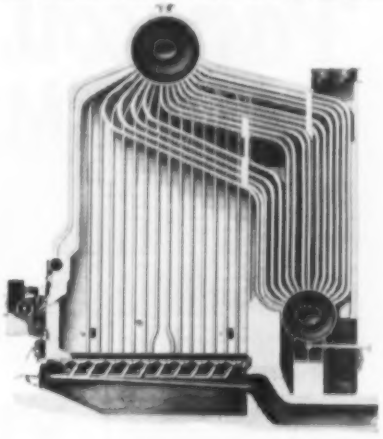
For stoker firing, the VU-10 is available from 10,000 to 60,000 pounds of steam per hour.

Whatever your fuel . . . whatever your steam capacity requirements up to 60,000 pounds per hour . . . you'll find that one of the Combustion Engineering Boilers described below will be just right for you.



The VP boiler

The C-E Package Boiler, Type VP . . . is completely shop-assembled . . . for oil or gas firing. It is available in capacities from 4,000 to 40,000 lb steam per hr; for pressures to 500 psi. The VP Boiler has more water-cooled area per cubic foot of furnace volume than any other boiler of its size and type. The large (30-in. diameter) lower drum permits a simple, symmetrical tube arrangement . . . greater water storage capacity . . . easy access for washing down or inspection. A low-speed, centrifugal fan, which is exceptionally quiet in operation, is standard equipment. Baffle arrangement is simple, resulting in low draft loss . . . simple soot blowing . . . high heat absorption. The unit is pressure fired . . . has welded, gastight, steel casing . . . requires no induced-draft fan.



The VU-10 boiler

The VU-10 Boiler is designed for industrial load conditions, particularly for plants with small operating and maintenance forces. Capacities range from 10,000 to 60,000 lb steam per hr . . . pressure to 475 psi . . . heat recovery equipment is available if desired. Fuel can be either coal (C-E Spreader, Traveling Grate or Underfeed Stoker), oil or gas. This boiler is a completely standardized design adaptable to many conditions. It responds readily to variations in load; is simple to operate and maintain. All parts are easily accessible for inspection. Like the VP, the VU-10 Boiler is a complete unit – boiler, furnace setting, fuel-burning equipment, controls, forced draft – bringing you the benefit of one contract . . . one responsibility.

Fully descriptive catalogs are available on both of these boilers. We'll be happy to send yours upon request.

COMBUSTION ENGINEERING

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

Canada: Combustion Engineering-Superheater Ltd.

B-8598

STEAM GENERATING UNITS; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; DOMESTIC WATER HEATERS; SOIL PIPE

NEW

The first safety barrier
FUEL OIL HEATER
that really delivers
hot oil!

Paracoil
THERMO-FILM*

100% true counter-flow – Straight tube construction delivers full rated capacity at high oil exit temperatures.

Safety-barrier – Heat transfer liquid between tubes eliminates all need for electric warning systems.

Extended tube surface – Greatly increases heat transfer capacity.

No electric wiring – Smaller, lighter, more compact than conventional type heaters.

LOWER FIRST COST – LOWER INSTALLED COST!
More capacity per dollar. The combination of straight tube design, extended tube surface, and special built-in features, gives you greater GPH in the Paracoil Thermo-film Heater in a given temperature range than any other comparable fuel oil heater. And its small size, lightweight and simplicity reduce installation costs too. Only five sizes required to cover all normal capacities.

Write today for Bulletin 60

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Davis Makes it! BETTER

DAVIS ENGINEERING CORPORATION
30 Rockefeller Plaza, New York 20, New York
1064 East Grand Street • Elizabeth 4, New Jersey

*Trademark/Patent Pending

RECENT TRADE LITERATURE . . .

▸ *ADHESIVES, COATINGS FOR INSULATIONS* — Characteristics, advantages of water base adhesives, protective coatings for industrial insulations described in new 4 page folder I-F 46. Products designed for uses in air conditioning, refrigeration, sound-deadening, moisture and corrosion control. *Flintkote Co., Dept. HPAC, 30 Rockefeller Plaza, New York 20.*

▸ *AIR CONDITIONING, HEATING, REFRIGERATION* — Wholesale buyers' guide No. 56 contains new items added to company's line of leak detectors, iron pipe and fittings, pumps, boilers, baseboard and standing radiation, heating valves, thermostats, etc., in 112 pages. *Airo Supply Co., Dept. HPAC, 2732 N. Ashland Ave., Chicago 14.*

▸ *AIR CONDITIONING, REFRIGERATION CONTROLS* — Bulletin No. 5610 presents design features, engineering data on new line of air conditioning, refrigeration motor controls. Contains voltage rating charts, outline diagrams, heater coil tables, application photographs, prices. *Furnas Electric Co., Dept, HPAC, 1041 W. McKee St., Batavia, Ill.*

▸ *AIR CONTROL VALVES* — New 72 page catalog illustrates company's line of two-, three-, four-way air control valves for high, low pressure installations. Features, application data, dimensions, specifications, parts list breakdown provided. *Airmatic Valve, Inc., Dept. HPAC, 7317 Associate Ave., Cleveland 9.*

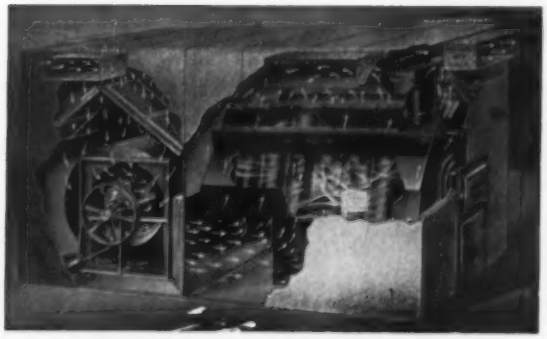
▸ *AIR FILTERS* — How office building effected large savings in maintenance costs is told in new bulletin 250-A-1. Tells how mechanical air filters were replaced by nine systems of "Electro-Matic" self-cleaning electronic precipitators to do this. *American Air Filter Co., Inc., Dept.*

WARM AIR HEATED... by Campbell

Community School addition, New Folden, Minnesota, heated with a No. 8125 Campbell stoker-fired unit. Installed 1953 by Broden Sheet Metal Works, Thief River Falls, Minn. Wells & Denbrook, architects, Grand Forks, N. D.

LOW COST SCHOOL HEATING

You can be sure of outstanding performance at suprisingly low cost when you specify Campbell Warm Air Heaters. Campbell gives you all the advantages of warm air heating; fast heat delivery, positive control of temperature, humidity and ventilation, and quiet operation — PLUS-low first cost, low installation cost, and low operating cost. Campbell Heaters are available for all fuels in capacities up to 3,150,000 BTUs.



MANUFACTURERS' AGENTS

We have a number of attractive openings for manufacturers' agents who call on heating contractors and architects. If interested, please state territory you cover.

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Des Moines 17, Iowa
I am interested in your proposition for manufacturers' agents.
My territory covers .....
NAME .....
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CITY ..... ZONE .... STATE .....

CAMPBELL HEATING COMPANY
Des Moines 17, Iowa

Omark HAMMER DRIVE

"NAILS" TO CONCRETE IN SECONDS WITH A HAMMER

No Drills • No Cartridges

Omark HAMMER DRIVE tools set fasteners in concrete or steel with 3 or 4 hammer blows. Drives headed or threaded hardened steel drivepins up to 4 inches long (over 30 types and sizes). No expensive drilling or fastening equipment needed . . . just a hammer. Not powder actuated . . . can be used anywhere.

Use it for hundreds of light fastening jobs: furring strips, cabinets, electrical conduit, window frames, shelving, tackless carpet strips, brackets, partitions, panel boards, ductwork and many others.

Ask your Omark dealer about HAMMER DRIVE tools, the inexpensive, speedy fastening method.

HOW TO USE Omark HAMMER DRIVE

1. Select drivepin and insert into bottom of tool barrel.
2. Insert correct driving ram into top of tool.
3. Place tool on work surface and hit the ram 3 or 4 times with a hammer.

It's that simple! No complicated mechanism, no drilling, nothing extra to buy.

Attractive Dealerships Open
Write for Information

You Always Get a Snug, Sure Fastening With Omark Ballistic Pointed Drivepins

Ordinary drivepins have straight shank, round point. Cause hole enlargement and fastening has less holding power. Pin is hard to drive and tends to buckle.

Omark pins have ballistic taper. Prevents hole enlargement. Gives snug, high-pullout fastening. Easy to drive, doesn't buckle. Better fastenings result.

The Only Complete Line of Drivepins
Headed, ¼"-20, 10-24 and 8-32 threaded pins from ⅝" to 3" long (4" on request).

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5001 S. E. JOHNSON CREEK BLVD. • PORTLAND 6, OREGON

RECENT TRADE LITERATURE
Continued

HPAC, 215 Central Ave., Louisville 8.

▸ *ALLOY STEEL TUBING* — Technical information on 12 of most widely used of company's "4100 series" of alloy steels presented in 4 page folder TDC-134. Included is condensed data on carburizing and thermal treatments, critical points, mechanical properties, suggestions on welding and machining. *Babcock & Wilcox Co., Tubular Products Div., Dept. HPAC, Beaver Falls, Pa.*

▸ *AXIAL FLOW FANS* — New 20 page brochure DAF-101 presents performance curves, specifications for line of aerodynamically designed axial flow fans. Models include individual, floor-stand "coolers," extended shaft models, cradle-slung floor units, large models for heavy industrial usage. *Detroit Blower Corp., Dept. HPAC, 9867 Pacific Ave., Franklin Park, Ill.*

▸ *AXIAL ROOF VENTILATOR* — Bulletin contains information, performance tables that explain how "Silent-Vent" roof exhauster is able to improve ventilating efficiency at very low tip speeds. Relates exhaust dissipation operating principle behind vaned ventilator head. *Detroit Blower Co., Dept. HPAC, 9867 Pacific Ave., Frank'in Park, Ill.*

▸ *BEARING MATERIAL CHART* — New chart designed for selection of proper material for sintering bronze or iron bearings. Shows chemical, mechanical, work characteristics of wide range of sintered bearing materials. *Bound Brook Oil-Less Bearing Co., Dept. HPAC, Bound Brook, N. J.*

▸ *BERYLLIUM COPPER* — Four page data sheet No. A-300 contains tables, graphs on beryllium copper. Features section detailing specific methods for heat treating. Gives engineering specifications on several of

MAMMOTH NEW ARLINGTON TOWERS TAKES PLENTY OF HEATING!

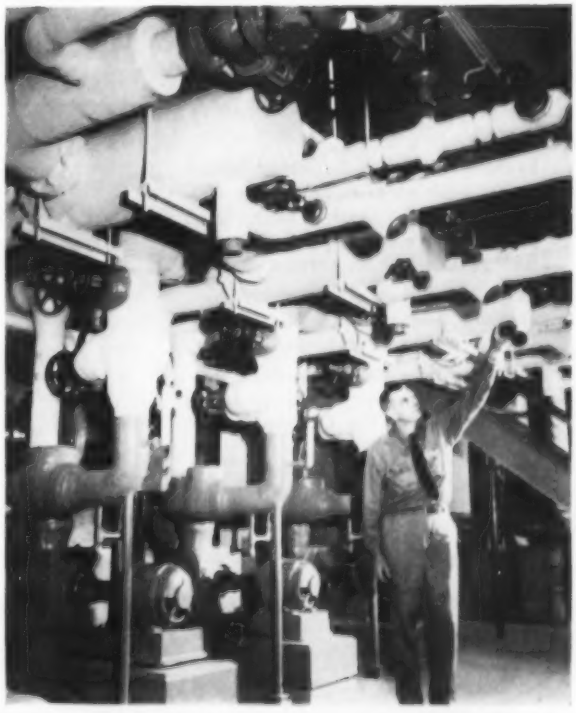
Arlington Towers, Arlington, Va., world's largest air-conditioned elevator type apartment project.

- *Cost:* $25,000,000
- *Architects:* G. V. Stone & D. H. Drayer, Washington, D. C.
- *Consulting Engineer for Heating:* General Engineering Associates
- *Mechanical Contractor:* W. H. Singleton Co., Inc., Arlington, Va.

. . . and 20 GENERAL Converters easily supply it for all 1684 apartments

Comfortable suburban living is the theme at beautiful new Arlington Towers Apartments. And an important part of the "comfort picture" is the heating of 869 efficiency apartments, 755 one-bedroom apartments, and 60 penthouses. GENERAL Converters do the job nicely. A compact bank of converters in each of the project's four spacious buildings provides high efficiency heat transfer from the steam lines to the circulating hot water system. There's always plenty of heat for each apartment.

This modern hot water heating system illustrates a typical application of GENERAL Converters in new apartment construction. Other successful installations of GENERAL Products are operating in all types of buildings from cottages to skyscrapers. Put GENERAL efficiency into *your* next job. Write for Catalog 61. General Fittings Co., Box 151E, East Greenwich, R. I.



One of four centralized banks of steam-to-water GENERAL Converters that supply heat for Arlington Towers. Four of the five converters in each building supply 160° F water at 190 to 270 g.p.m. The fifth in each bank (not shown) supplies 200° water at 65 to 80 g.p.m.

GENERAL FITTINGS COMPANY

Manufacturers of Instantaneous Water Heaters, Converters, Fuel Oil Heaters, and Heating Specialties

KENNEDY Quality
Low Pressure Valves

Set a New high standard of . . .

• Performance
• Construction
• Dependability

KENNEDY Low Pressure valves are manufactured of the same high quality bronze used in Kennedy 125 lb. valves. New, modern design for maximum strength with light weight; extra rigidity prevents distortion of the body when valve is being seated.

Each valve part is inspected seven times; each valve is subject to 300 lb. hydrostatic test; each low-pressure valve gets the same inspection as 125-300 lb. valve.

Easy installation of Kennedy Low-Pressure valves saves installation time, resulting in true economy.

These outstanding developments are what make Kennedy Low-Pressure Valves the Quality line.

WRITE TODAY for CHECK CHARTS

For Iron-Body and Bronze valves, show at a glance correct valve for various installations.

No obligation.

Fig. 1
Designed for installation in steam and water lines where working conditions are not especially severe.

Fig 151
For low pressure steam and 150 lb. water services at temperatures up to 250° F. (when joints are made up with ordinary solder.)

Fig 87
Made from the same quality materials as Kennedy Standard Valves, but for lower pressure services.

Fig. 104
For general service which is not severe. Swing disc on hinge is fitted with a stop to prevent sticking in the open position.

Fig. 5
For systems which require shut-off valves, where working conditions are not severe.

Fig. 9
For use on hot water radiator heating systems especially designed for ease of operation (open or close in one-quarter turn.)

THE KENNEDY VALVE MFG. CO. • ELMIRA, N. Y.
VALVES • PIPE FITTINGS • FIRE HYDRANTS
OFFICE AND WAREHOUSES IN NEW YORK CHICAGO SAN FRANCISCO ATLANTA SALES REPRESENTATIVES IN PRINCIPAL CITIES

RECENT TRADE LITERATURE
Continued

more generally employed beryllium copper alloys. *American Silver Co., Dept. HPAC, 36-07 Prince St., Flushing 54, N. Y.*

▸ *BOILER FEEDWATER TREATMENT — How to Use Scav-Ox in Low Pressure Heating Boilers* is title of literature discussing use of hydrazine solution in boiler feedwater treatment. Covered are packages available, dosage, handling, testing, results. *Olin Mathieson Chemical Corp., Industrial Chemicals Div., Dept. HPAC, Baltimore 3.*

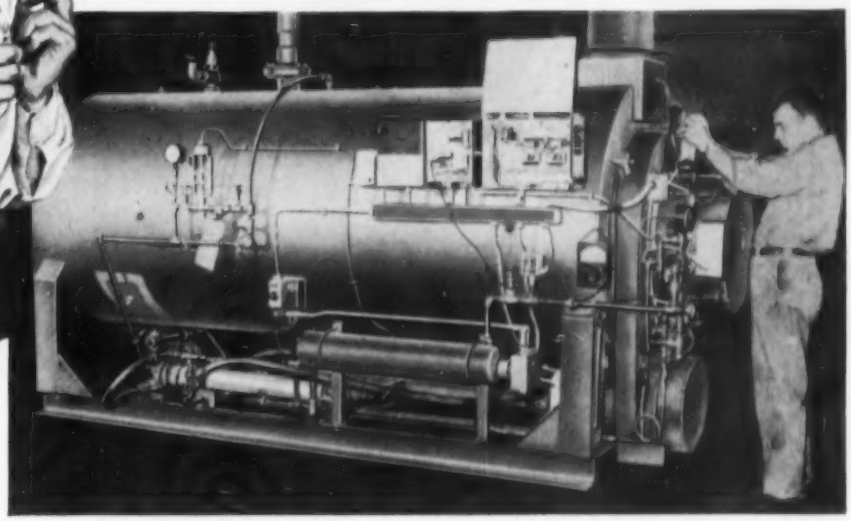
▸ *BOILERS* — Literature contains illustrations, cites features, presents specifications, shows dimensional drawing of company's water tube steel heating boilers for apartment buildings, office buildings, schools, theaters, hotels, etc. *International Boiler Works Co., Dept. HPAC, East Stroudsburg, Pa.*

▸ *BOILERS* — Cited economic advantages of "LoSet" steel boilers for oil firing to engineers, contractors, building owners, architects discussed in 8 page catalog AP 279-B. Tables, charts, diagrams give sizing, rating, installation, engineering data for units. *Pacific Steel Boiler Div., National-U. S. Radiator Corp., Dept. HPAC, Johnstown, Pa.*

▸ *BOILERS* — New 4 page bulletin B-3300-A covers range of power and heating boilers in company's line. Units designed to provide 97 to more than 8000 sq ft of heating surface. *Struthers Wells Corp., Titusville Iron Works Div., Dept. HPAC, Titusville, Pa.*

▸ *CANNED MOTOR PUMP* — Bulletin 1060 describes, illustrates "Series E Chempump." Cites details on performance, NPSH requirements, materials of construction, power inputs, temperature and pressure limitations, dimensions. *Chempump Corp., Dept. HPAC, Station N, 1300 E. Mermaid Lane, Philadelphia 18.*

"Engineers know the value of an ENGINEERED PRODUCT . . . That's why we like Packaged Boilers"



"As an engineer, I know the importance of using only an engineered, integrated, smoothly functioning unit. That's why I like a Packaged Boiler.

"A built-up fire-tube boiler is usually assembled from unrelated components. Often no two of its parts were specifically designed for simultaneous operation in the same boiler. The result is noise, vibration, rapid sooting, and a general lowering of boiler efficiency.

"A Packaged Boiler, on the other hand, is an engineered product. Every part is specifically designed to function with every other part at maximum efficiency. That means quiet, low-cost operation . . . vibration-free performance . . . soot removal twice a year instead of once a day.

"As an engineer, I know that a Packaged Boiler pays off in satisfactory performance, greater efficiency, less maintenance."

Six Reasons Why it Pays to Buy a

CONTINENTAL

Automatic Boiler

* Guaranteed 80% efficiency . . . Fire-tested before shipment . . . Range, 20 to 500 hp.
* Simple, practical two-pass design, for uniform flow of combustion gases through all return tubes.
* Maximum radiant heat transfer achieved by "Spinning Gas" technique for thorough mixing of air and atomized fuel.
* High-CO_2 and low-temperature stack gases — proof of high combustion efficiency.
* Free, rapid water circulation improves heat transfer, keeps heating surfaces clean.
* Easy access to furnace and all return tubes. Refractory baffles and brickwork are not required.

For details on the Continental Automatic Boiler, send for Bulletin BE-3

BOILER ENGINEERING & SUPPLY COMPANY, INC.

8 Manavon Street, Phoenixville, Pa.

A HALF CENTURY OF BOILER MANUFACTURING EXPERIENCE

The Continental AUTOMATIC BOILER

SO CONNECTIONS MUST COMPENSATE

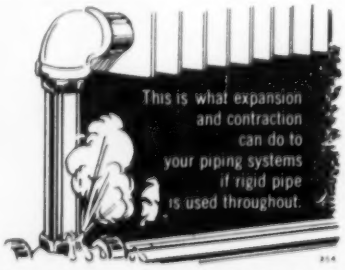
That's why Packless® is first and foremost in the design, engineering and manufacture of seamless metal flexible hose that

- *ABSORBS EXPANSION*
- *CONTROLS VIBRATION AND PIPE TRAVEL*
- *DAMPENS NOISE*
- *CORRECTS MISALIGNMENT*
- *PREVENTS PIPE DAMAGE*

A complete line of standard connectors, in sizes from ¼" to 4" I.P.S. are available for immediate delivery. Engineering service for *your* specific requirements is offered at no extra cost.

Call or write now for special technical bulletins or further detailed information. Please give us a general idea of your problem so that we may be of greater assistance to you.

Distributors and Representatives wanted: Some territories still open



PACKLESS
METAL HOSE INC. 31-12 Winthrop Ave., New Rochelle, N.Y.

RECENT TRADE LITERATURE

Continued

▸ *CARBON STEEL TUBING* — Technical data card 142A furnishes condensed data on mechanical, physical properties of seamless and welded carbon steel pressure tubing. Supplies information on various fabricating operations normally performed on such tubing. *Babcock & Wilcox Co., Tubular Products Div., Dept. HPAC, Beaver Falls, Pa.*

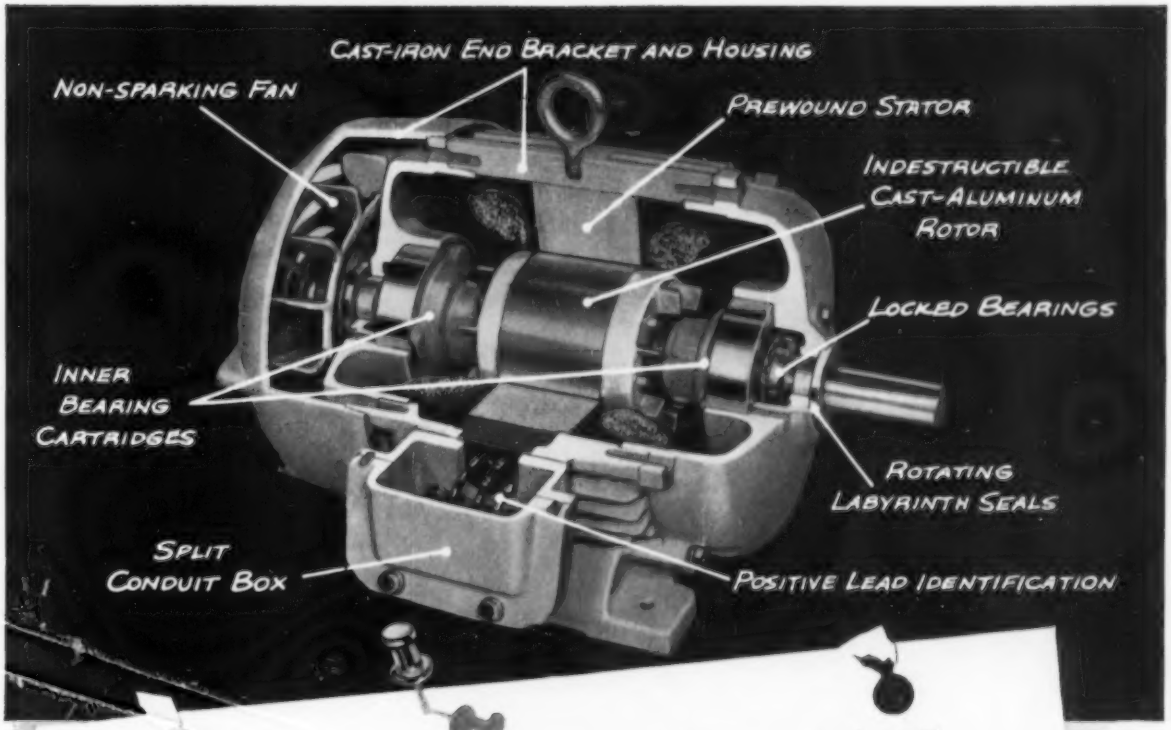
▸ *CENTRIFUGAL PROCESS PUMPS* — Circular No. 184 contains sizes, head capacity range charts, sectional view and parts list, list of materials of construction of centrifugal process pumps for industrial, refinery, general service. *Dean Brothers Pumps, Inc., Dept. HPAC, 323 W. 10th St., Indianapolis.*

▸ *CENTRIFUGAL PUMPS* — "Monobloc" centrifugal pumps for air conditioning systems, with heads to 120 ft and capacities to 240 gpm, covered in bulletin W-306-B3D P. Literature graphically illustrates ratings, dimensions, variety of sizes available. *Worthington Corp., Dept. HPAC, Harrison, N. J.*

▸ *CONDENSATE RETURN PUMPS* — New 4 page bulletin No. H-1 describes design, construction features of company's "NCR" single, "NCRD" duplex condensate return pumps. Includes photographs, dimensional drawing, selection tables, operating data. *C. H. Wheeler Mfg. Co., Dept. HPAC, 19th and Lehigh Ave., Philadelphia 32.*

▸ *CONDENSER* — All-season "Unicon" remote type condenser described in new bulletin U21OD. Application information, specifications, selection charts cover sizes to 300 tons. *Kramer Trenton Co., Dept. HPAC, Trenton 5, N. J.*

▸ *CONDENSERS, COMPRESSORS* — Two product catalogs cover ¼ to 4 hp line of semi-hermetic condensing units and high torque motor compressors. Bulletin G-141 contains 24



Are you getting all these extras in the motors you buy?

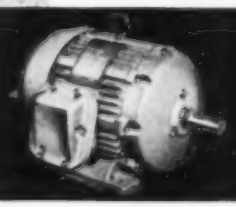
Louis Allis gives them to you in the new L. A. enclosed and explosion-proof motors

For years, Louis Allis has specialized in special motors for many of industry's toughest drive problems. Such installations call for extreme care in both motor design and manufacture—care that has become a habit with us. We build our enclosed and explosion-proof motors with the same special care.

What does this mean to you? It means that you get a motor with extra features—a motor that runs better, lasts longer. Here are a few of the extra reasons why:

- These new motors carry Underwriters' label for use in four groups of hazardous locations—Class I, Group D, and Class II, Groups E, F, and G. This four-group approval for a single motor simplifies your stocking problem.
- New, exclusive phenolic impregnating varnish provides high thermal and chemical resistance. It remains resilient and resists aging, prolonging the life of the motor.
- Inner bearing cartridges lock bearings to end bracket and form explosion-quenching seal along the shaft. Inner race of bearing locked to shaft, reducing end play—an extra quality feature.
- Rotating labyrinth seals keep dirt and moisture out of the bearings—keep grease in.

There are many other features such as a new diagonally split conduit box, sturdy cast-iron construction, positive lead identification, non-sparking fan. Our new bulletin No. 1700 shows why you get extra value for your dollar in a Louis Allis explosion-proof motor. Write for your copy.



New LA line explosion-proof motors are available in rerated frame sizes 182 through 326U, and in ratings of 1 to 30 hp, 3 phase, and 1 to 5 hp, single phase. Also available with Underwriters' approval for Class I, Group C hazardous locations.

EP-102

THE LOUIS ALLIS CO.
MILWAUKEE 7, WISCONSIN

FITZGIBBONS "D" TYPE STEEL BOILER

"How can you improve as good a product as the "D" Type boiler?" It's a natural question when you consider that here is a boiler with sound, basic design, strong, careful construction and with a reputation for the highest standards of performance throughout the big building field. But a leader never stands still and Fitzgibbons engineers are constantly striving for additional improvements that better suit today's trends of installation. Hence, the following new features, sure to please engineers and contractors:

- **Improved front smokebox access doors provide greater clearance for automatic firing equipment. Complete smokebox design assures a gas-tight fit.**
- **Rear smokebox also redesigned for tighter fit and easier accessibility.**
- **Lifting eyes in the front and rear heads for easier rigging on the job.**
- **Front and rear heads now extend beyond the sides to facilitate covering the boiler on the job.**

See your Fitzgibbons representative or write: FITZGIBBONS BOILER COMPANY, INC. 101 PARK AVENUE, NEW YORK 17, N. Y. for full details.

SINCE 1856

The Fitzgibbons Boiler

RECENT TRADE LITERATURE

Continued

pages, gives comprehensive presentation. Four page catalog contains condensed version of formal catalog. *Brunner Mfg. Co., Dept. HPAC, Utica, N. Y.*

▸ *CONTROLS — Use automatic controls for better water distribution* is title of 2 page article contained in 4 page reprint. Discusses how aircraft propeller manufacturer used control system to achieve constant pressure in water system. *Automatic Control Co., Dept. HPAC, 995 University Ave., St. Paul 4.*

▸ *CONTROLS* — New 20 page bulletin CG-71 contains listing of company's entire "Fireye" product line, which includes: panel control systems, flame safeguards and programming controls, flame indicators and alarms, flame scanners, accessories, control enclosures, valves, operating controls and limit switches, smoke density indicators and recorders, replacement parts, factory reconditioned controls. *Electronics Corp. of America, Dept. HPAC, 718 Beacon St., Boston 15.*

▸ *CONVERTIBLE PUMP* — Bulletin describes company's "Adapto-Jet" pump line, series "4100." Lists construction features, models available, performance data, dimensional specifications. *A. Y. McDonald Mfg. Co., Dept. HPAC, Dubuque, Iowa.*

▸ *COOLING* — Form No. 2190 says cooling equipment using dry air as cooling medium should be designed to operate under dry bulb temperatures to be expected locally. Likewise, equipment using cooling effect due to exaporation is designed to operate under expected wet bulb temperatures. Literature contains maps of U. S. showing related dry bulb, wet bulb temperatures. *Young Radiator Co., Dept. HPAC, Racine, Wis.*

▸ *COOLING TOWERS* — New 12 page catalog covers company's new "MT" line of cooling towers. Details

Comfort for the Comfortless...

Radiant heating chosen for cerebral palsy school!

For the ill, afflicted or handicapped, who endure so much emotional distress, physical comfort becomes all the more important. Definite therapeutic values are ascribed to physical well being derived from proper lighting, ventilation, sanitation, pleasant surroundings . . . and modern heating.

More and more (as in the Walter D. Matheny School for Cerebral Palsy Children, Peapack, N.J.) radiant heating systems are selected to provide vital, draft-free heat, warm floors and equalized temperatures.

For these comfort-giving radiant systems *steel pipe is first choice*. Proved in more than 60 years of heating applications, it has the qualities of economy, durability, weldability and formability required for successful installations. In fact it is the most widely used pipe in the world for heating, plumbing, snow melting, fire sprinkler systems, structural applications, gas and water lines!

Write for the free 48 page color booklet "Radiant Panel Heating with Steel Pipe."

Committee on
STEEL PIPE RESEARCH
AMERICAN IRON AND STEEL INSTITUTE
150 EAST FORTY-SECOND ST.,
NEW YORK 17, N.Y.

Steel Pipe is First Choice

How to stop noise, vibration and "hammer" in water lines

THE ORIGINAL SOUNDZORBER expressly designed for use in air conditioning water lines . . .

A wire-reinforced wrapped fabric rubber pipe, SOUNDZORBER can be used continuously in water lines at up to 250 psi working pressure (safety factor: 5 to 1).

Smaller sizes ½" to 3" available with male I.P.T. bronze fittings. Larger sizes available with integral full-faced rubber flanges backed up with Series 15 or Series 30 steel flanges. No metal-to-metal contact.

SOUNDZORBER is but one of a complete line of Finn vibration controls. Finn has control devices for every vibration problem in your field. Write for complete information.

FINN

VIBRATION FINNFLEX CONTROL

INDUSTRIAL DIVISION

T. R. FINN & COMPANY, INC.
200 Central Ave., Hawthorne, N. J.

RECENT TRADE LITERATURE
Continued

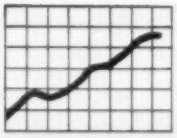
given for 23 sizes, from 10 to 400 tons, for air conditioning and refrigeration applications. Selection charts designed to aid selection of units under any load conditions. *Baltimore Aircoil Co., Dept. HPAC,* 2615 *Mathews St., Baltimore* 18.

▸ *COOLING TOWERS* — Basic changes in company's "Wet-R-Miser" line of cooling towers described in new 4 page bulletin C-H.56110. Key improvements to line stressed, including addition of complete housing water-tight seal designed to prevent leakage at joints, motor guard protection, raised legs place of flush-to-floor design. *Drayer-Hanson, Inc., Dept. HPAC,* 3301 *Medford St., Los Angeles.*

▸ *COOLING TOWERS* — Method for selecting cooling towers or for determining performance under varying conditions offered in catalog 32C6a. Charts, tables provide graphical method designed for quick selection of tower from conditions given, or if tower size is known, final water conditions can be easily determined, says company. *Refrigeration Engineering, Inc., Dept. HPAC,* 7250 *E. Slauson Ave., Los Angeles.*

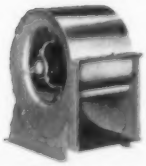
▸ *CORROSION PROOFING* — Revised edition of reference manual on corrosion proofing provides information on new developments in field. Included are descriptions of applications of "Corlok" chemical resisting mortar recently introduced by company. *Pennsylvania Salt Mfg. Co., Dept. HPAC,* 3 *Penn Center Plaza, Philadelphia* 2.

▸ *DEAERATION* — Publication 4650 explains in condensed form the fundamentals of deaeration, why it is necessary in water conditioning. Principles of operation, advantages, various methods of deaeration discussed. *Cochrane Corp., Dept. HPAC,* 17*th St. below Allegheny, Philadelphia* 32.



When sales go up do you "scramble" for deliveries?

Brundage stocks can save the day



STOCKS INCLUDE

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- DUCT BLOWERS
- BLOWER FILTER UNITS
- EXHAUSTERS
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Everyone runs into tight scheduling once in a while. The seasonal quality of the heating and air conditioning industry makes an occasional "hurry up" call unavoidable.

When this happens to you, Brundage is a good name to keep in mind.

New warehouse capacity—coupled with a fast order handling procedure—can help you avoid unnecessary shut-downs. And it can help you take advantage of an up-swing in business that you might otherwise be unable to handle.

MANUFACTURERS: Brundage Universal Blowers can often solve your production problems because they are a stock item and can meet most applications.

Blower specialists since 1919

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TELEPHONE 2-0251

SPACE-SAVERS!!

a new line of DEMING condensation return units

LOW PRESSURE UNITS
(20 to 50 P. S. I.)

Only 19" in diameter and 20¾" high are the space-saving dimensions of Deming Fig. 4958 LP units with 6 gal. receiver. Also available with 20 gal. receiver. Ratings from 1,000 to 10,000 sq. ft. direct radiation.

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(30 to 50 P. S. I.)

Only 30¾" in diameter and 21¼" high are the space-saving dimensions of Deming Fig. 4958 higher pressure units with 20 gal. receiver. Also available with 6 gal. receiver. Ratings from 1,000 to 6,000 sq. ft. direct radiation.

DUPLEX UNITS

Deming Fig. 4958 Duplex Units are available in both lower and higher pressure units. Pumps operate in sequence or both at same time. When operating together at same time, Duplex Units deliver twice the capacity of a single pump.

The New Line of Deming "HOTSHOT" Condensation Return Units are real space-savers. Only 2½ square feet of floor space is required for units with 6 gallon tank; only 6½ square feet for units with 20 gallon tank.

Simplified, rugged construction and economy of operation recommend these modern units for a wide variety of conditions. Illustrated BULLETIN 4958-B gives full details. Write for your copy.

THE DEMING COMPANY
560 BROADWAY • SALEM, OHIO

RECENT TRADE LITERATURE

Continued

▸ *DEAERATOR* — Publication 4651 describes deaerator design said to eliminate tubular vent condensers without impairing efficient purging of noncondensible gases. *Cochrane Corp., Dept. HPAC, 17th St. below Allegheny, Philadelphia 32.*

▸ *DIAL THERMOMETERS* — Bulletin 149 cites features, lists general specifications, illustrates, provides dimensional drawings for company's 3 and 5 in. dial thermometers. *Manning, Maxwell & Moore, Inc., Dept. HPAC, Stratford, Conn.*

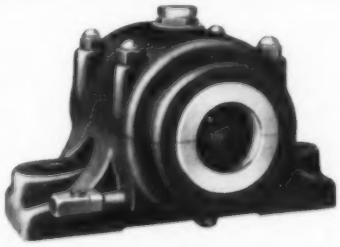
▸ *DUCT INSULATION* — Engineering data, application instructions for semi-rigid, spun mineral wool duct insulation contained in 4 page bulletin. Thermal, sound absorption characteristics presented in tabular form. Physical, chemical, mechanical, handling properties also described. *Baldwin-Hill Co., Dept. HPAC, 500 Breunig Ave., Trenton, N. J.*

▸ *DUST COLLECTION* — *You Can Solve That Dusty Cost Problem* is new booklet describing principles of unitized dust collection, its advantages and savings. Booklet No. 56 gives general product information, uses, reductions in operational expenses. Photomicrograph of various types of industrial dust is included. *Torit Mfg. Co., Dept. HPAC, 292 Walnut St., St. Paul 2.*

▸ *DUST COLLECTOR* — New "Ventrijet" dust collector designed for wet collection of industrial dusts illustrated, described in 8 page bulletin No. 920. Photographs, drawings show action of unit. Dimensions, weights, capacities presented in tables. *Pangborn Corp., Dept. HPAC, Hagerstown, Md.*

▸ *ELECTRONIC AIR CLEANER* — Information in new 12 page catalog E-61 gives complete engineering data, size and capacity tables, component parts of company's field assembled electronic air cleaners. *Trion, Inc.,*

Bright Lights–That Never Fail



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Dodge Sleevoil Bearings are available in plain type, water-cooled, or air-cooled for outside use—all self-aligning—all drilled for thermostatic emergency warning. Shaft sizes from 1-7/16" to 10".

The brilliant lights of Broadway match the stars in the certainty of their rising. A black-out from power failure is almost unthinkable.

One factor that contributes to the dependability of this steady power supply is the bearing that insures unfailing operation of mechanized draft in the generating plant.

These Bearings are Dodge Sleevoil.

Generating plants throughout America—including those in such metropolitan centers as New York, Detroit, San Francisco, Los Angeles—use these super-quality bearings.

The Sleevoil Bearing is a Dodge development, created especially to meet the exacting requirements of fan and blower service. You are invited to write us for our new Engineering Catalog D56, which contains detailed description, sizes, dimensions.

DODGE MANUFACTURING CORP., 1600 Union St., Mishawaka, Indiana

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on modern power transmission machinery for *modern* installations. Look for his name under "Power Transmission Equipment" in your classified telephone directory.

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of Mishawaka, Ind.

WHERE A "BUFFALO" CLOSE-COUPLED PUMP IS YOUR BEST CHOICE

1. *Where space is limited,* "Buffalo" CCL Pumps are unequalled for compact design with high capacity. For example, a 4" pump with 15 HP motor, takes up less than 2 cu. ft., yet delivers 600 gpm at 60-ft. head.

2. *Where "package" installation is desirable,* you have a ready-to-run unit with shaft permanently pre-aligned for fast, simplified installation on the site or as part of original equipment. Readily adjustable to 4 discharge positions.

3. *Where you want high efficiency,* you will find these pumps up to the high performance standards of all "Buffalo" Pumps.

4. *Where you want durability and freedom from troubles,* "Buffalo" Close-Coupled Pumps are an ideal choice. They are built to take punishment — with heavy cast mounting brackets, rugged shell, husky, accurately machined impeller, large diameter shaft and stuffing boxes holding at least 8 rings of packing. Side plate (inlet) is readily removable to give access to rotor. You have a husky, easily serviced unit.

These and other "Q" Factor* advantages are yours in any clear water service up to 1100 gpm, when you specify "Buffalo" Close-Coupled Pumps. Write for Bulletin 975 for full details.

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

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RECENT TRADE LITERATURE

Continued

Dept. HPAC, 1000 *Island Ave., McKees Rocks, Pa.*

▸ *EXTRUSIONS* — Six page folder TB-413 covers company's line of extruded products. Describes facilities for production of tubular, solid shapes. Explains hot "Ugine-Sejournet" extrusion process as used by company. *Babcock & Wilcox Co., Tubular Products Div., Dept. HPAC, Beaver Falls, Pa.*

▸ *FITTINGS* — "Zytel" (nylon resin) fittings described in 4 page folder. Working operation covered. Specification tables for various types included. Features cited. *Jaco Mfg., Dept. HPAC, Box* 2659, *Cleveland* 7.

▸ *FITTINGS, FLANGES* — New 6 page folder, bulletin FB-502, cites features, illustrates, presents table of types and sizes of company's seamless welding fittings and flanges of carbon, alloy, stainless steels. *Babcock & Wilcox Co., Tubular Products Div., Dept. HPAC,* 3839 *W. Burnham St., Milwaukee* 46.

▸ *FLUOROCARBON PRODUCTS* —Forms, properties, uses of range of fluorocarbon products—from plastic resins to acids and dielectric fluids — described in new 8 page brochure. Detailed are types, grades available of each form of "Kel-F" products, suggested uses. *M. W. Kellogg Co., Dept. HPAC, P.O. Box* 469, *Jersey City* 3.

▸ *FOG NOZZLES* — New catalog details features of company's line of fog nozzles. Illustrations, dimensional drawings, specification tables given. *Bete Fog Nozzle, Inc., Dept. HPAC, Greenfield, Mass.*

▸ *GAGE TOLERANCES* — Data card contains gage tolerance tables for round welded mechanical tubing of cold rolled carbon steel, hot rolled carbon steel. *Nikoh Tube Co., Dept. HPAC,* 5000 *S. Whipple St., Chicago* 32.

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by Phil Tration

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VENTILATION FILTER

Yes, Dollinger makes filters for almost *all* filtration problems. For heavy duty ventilation work, the Dry Panel Filter illustrated at the right is extremely efficient.

The Dollinger Dry Panel Filter operates with any filtering material that comes in sheet form and can be crimped. Preformed filtering elements are available for quick and easy replacement when necessary.

Whatever your filtering problems, wherever you are, there's a Dollinger representative ready to help you solve it . . . write today and ask for ventilating filter catalogs, Dollinger Corporation, 9 Centre Park, Rochester 3, N. Y.

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LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS
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"Lowest Price and Highest Quality are seldom found in the same product."

Golden-Anderson concentrates on high quality — the surest way to lowest cost in the long run. That's why G-A Valves do the job they were designed for—accurately . . . dependably . . . constantly, and with minimum maintenance.

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There is an Electro-air Electronic Air Cleaner of suitable dimensions and air handling capacity to furnish clean pure air in every size building—from the smallest home to the largest office building.

"Compact Line" units—800-4,800 cfm
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RECENT TRADE LITERATURE

Continued

▸ *GAS HEATERS* — Catalog No. 56 lists company's line of "Brilliant Fire" room and apartment models of gas heaters, except wall and floor furnaces. Specifications given for 43 models, including new series of vented circulators with optional blower. *Ohio Foundry & Mfg. Co., Dept. HPAC, Steubenville, Ohio.*

▸ *HEATING, COOLING COILS* — New 36 page catalog covers standard line of "Tru-Air" heating and cooling coils. Illustrates helical fin construction, methods of fabrication, etc. Includes dimensional data. *M. Blazer & Son, Dept. HPAC, 173 Market St., Passaic, N. J.*

▸ *HOSE ACCESSORIES* — New 8 page booklet No. 18 covers "Le-Hi" hose couplings, hose clamps, hose nipples, valves and manifolds for general industrial applications. *Hose Accessories Co., Dept. HPAC, 2700 N. 17th St., Philadelphia 32.*

▸ *HOT WATER FOR SWIMMING POOLS* — Bulletin CH-305 defines needs of motels, hotels, clubs, etc., for maintaining adequately heated swimming pool water. Brochure offers data on sizing, installation of water heating equipment for pools of various dimensions, capacities. *Permaglas Div., A. O. Smith Corp., Dept. HPAC, Kankakee, Ill.*

▸ *INSTRUMENTS, TEST EQUIPMENT* — New No. 17 technical manual describes line of electrical indicating instruments, test equipment. Illustrated with photographs, wiring diagrams, dimensional drawings. *Simpson Electric Co., Dept. HPAC, 5200 W. Kinzie St., Chicago 44.*

▸ *LIQUID LEVEL INDICATOR* — Application of company's remote liquid level indicator to boiler installations, in relation to ASME Boiler Code Case 1155, described in new 4 page bulletin. *Yarnall-Waring Co., Dept. HPAC, Mermaid Ln., Philadelphia 18.*

To meet an estimated heat loss of 7,400,000 Btu per hour in their new plant, Hunter Fan installed five 1,000,000 Btu, four 500,000 Btu and one 400,000 Btu Dravo Counterflo Heaters.

The new L-shaped factory building, 350 by 420 feet, supplies 108,000 square feet of manufacturing and storage space. Dravo Heaters meet varying heat requirements easily despite the fact that one-sixth of plant's total wall space is window area.

Southern factory finds economical answer to plant heating problem

Much of the South's rapid industrial expansion can be credited to its year-around sunny, mild climate. But this same climate has presented some unique heating problems to manufacturing firms like Hunter Fan and Ventilating Company of Memphis, Tennessee. Their particular problem was to provide an efficient yet economical heating system for their new factory building.

In addition to the normal heating requirements, experience indicated that "chill" conditions prevailed during many winter and early spring days, particularly in the morning hours. This "part time" heat requirement indicated the need for a conventional system that could not only handle their normal needs but also have sufficient flexibility to meet these varying demands. Specifically what they needed, Hunter plant engineers decided, was a system that instantaneously handled a wide variation of heat requirements and yet was low in initial cost, maintenance, and compact enough to fit limited space in modern, low factory structure.

As cooling and ventilating specialists, they examined and evaluated all types of heaters and heating systems. Ten Dravo *Counterflo* heaters were found to be the ideal answer to their plant heating requirements.

Regardless of your plant location—East, West, North or South—you'll be dollars ahead by carefully investigating Dravo's quality heaters to see how their many features work for over-all heating efficiency and economy every day of operation. The coupon below will bring you all of the details—mail it today!

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Adjustable
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with Chain Guide

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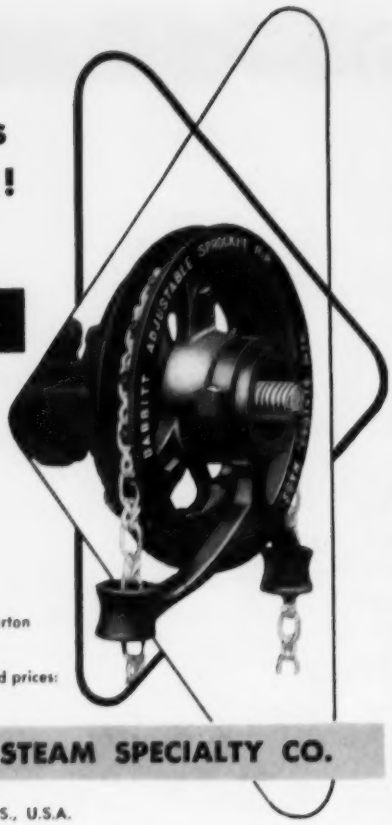

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RECENT TRADE LITERATURE

Continued

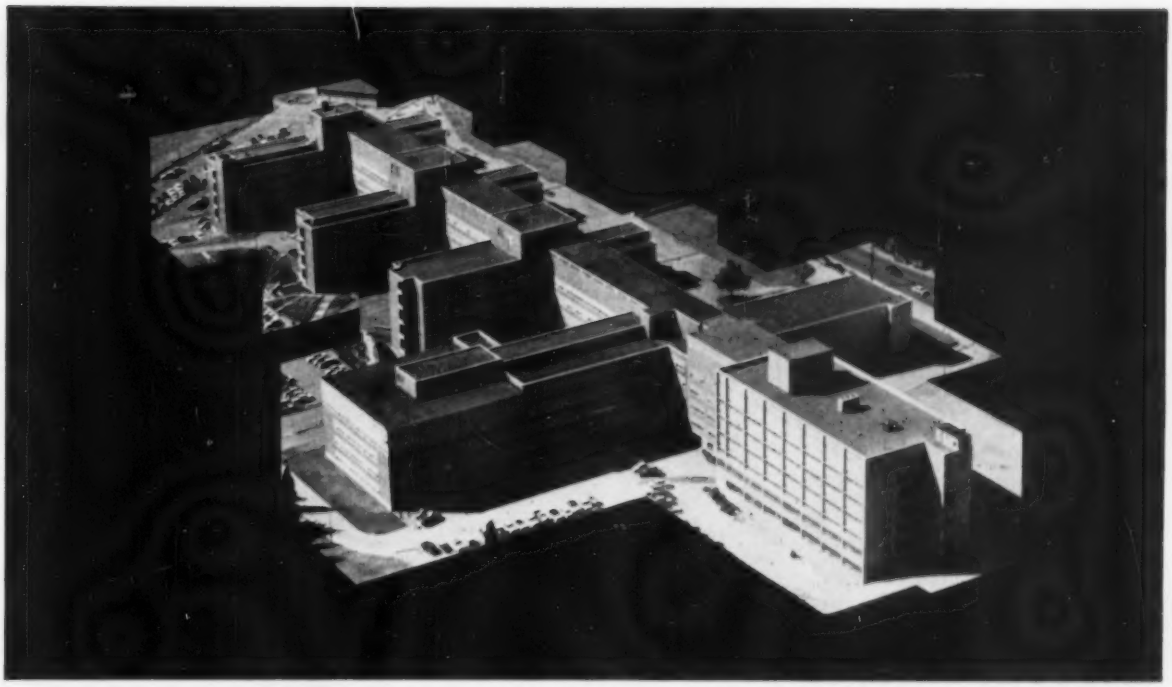
▸ *LOW TEMPERATURE INSULATION* — "Uni-Crest" expanded and expandable polystyrene low temperature insulation material discussed in 4 page folder. Photographs illustrate features. *United Cork Companies, Dept. HPAC, Kearny, N. J.*

▸ *MACHINES, TOOLS* — 1956 catalog shows latest additions to company's line of punches, shears, presses, brakes, power presses, etc. Contains descriptions, prices of hand tools, special tools. Companion publication to 48 page catalog contains data, prices on punches, dies available. *Whitney Metal Tool Co., Dept. HPAC, Rockford, Ill.*

▸ *MOTORS* — Construction features of company's wound rotor motors for variety of applications detailed in new bulletin 51B8195A. Units designed for use where high starting torque with low starting current is needed, power supply is limited, intermediate speeds are required, smooth acceleration is desired, or where high inertia loads must be accelerated. *Allis-Chalmers Mfg. Co., Dept. HPAC, 1171 S. 70th St., Milwaukee.*

▸ *MOTORS* — New 4 page form 943 contains specification tables, dimensional drawings for company's squirrel cage induction motors, wound rotor induction motors, d-c motors, gear motors, single phase motors, split phase induction motors, capacitor and repulsion start induction motors, controls. *Century Electric Co., Dept. HPAC, 1806 Pine St., St. Louis 3.*

▸ *MOTORS* — Condensed motor catalog contains cross reference between old and new NEMA motor ratings. Covers current pricing for 1/20 to 1000 hp motor sizes on both fractional, integral hp models. Includes adapter basis, prices from old to new NEMA frame mountings. *Marathon Electric Mfg. Corp., Dept. HPAC, Wausau, Wis.*



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TO HANDLE CORROSIVE WASTES AT UNIVERSITY OF WASHINGTON

DURIRON was the choice for acid proof piping at the new Health Science Building and Teaching Hospital at the University of Washington.

Certain advantages are obvious. DURIRON is the high silicon iron with resistance to corrosion, abrasion and erosion that architects have specified with confidence for more than thirty years. DURIRON is installed by ordinary plumbing methods. It generally outlasts the building; therefore, the first cost is the last cost. No finer recommendation can be made.

Always insist on DURIRON. Stocked by leading plumbing jobbers. Request Duriron Catalog PF/4 for details, or see Sweet's Architectural File.

THE DURIRON COMPANY, INC., DAYTON, OHIO

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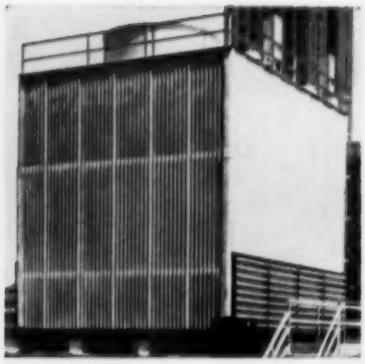
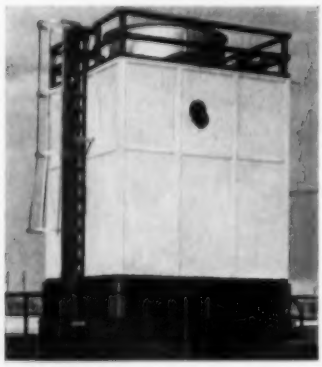


The Phillips Transite Cooling Towers have been in operation over nine years and proven to furnish the required cooling with lowest possible maintenance cost. Phillips Towers are available with framing of California Redwood or Hot Dipped Galvanized Steel as preferred.

The new Phillips nailless fill adds to simplicity of erection and maintenance.

The Phillips eliminator system guarantees minimum drift loss.

When you have a cooling problem call your Phillips representative.



Phillips Cooling Tower Co., Inc.
220 DUPONT ST., BROOKLYN 22, N.Y.

RECENT TRADE LITERATURE

Continued

▸ *MOTORS* — Revised bulletin No. 1878 includes more complete line of company's motors. Described are open type "Uniclosed" designs, totally enclosed and explosionproof types, "Varidrives," "Syncrogears," right angle worm gear models; also vertical motors and "Verticlosed" hollowshaft types. *U. S. Electrical Motors, Inc., Dept. HPAC, Box 2058, Los Angeles 54.*

▸ *MOTORS* —Construction features of large end-shield bearing synchronous motors detailed in bulletin 05B-8305. Units designed for direct-connected or geared applications to drives for centrifugal blowers, compressors and fans, centrifugal pumps, etc. *Allis-Chalmers Mfg. Co., Dept. HPAC, 1171 S. 70th St., Milwaukee.*

▸ *PACKAGED AIR HEATERS* — Illustrations, specifications for light and heavy oil fired and gas fired packaged air heaters contained in new catalog. Engineering data sheets, dimensional drawings with tables included. *Auto-Therm Mfg. Co., Dept. HPAC, 6400 E. Seven Mile Rd., Detroit 34.*

▸ *PACKAGED CHILLERS* — Revised "Cold Generator" bulletin DS-352 covers line of 10 to 150 hp packaged reciprocating water chiller units for industrial and commercial, comfort or process applications. *Trane Co., Dept. HPAC, La Crosse, Wis.*

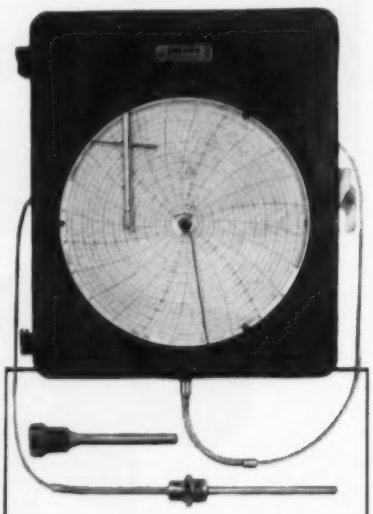
▸ *PNEUMATIC OPERATORS* — Bulletin B-1020-5 illustrates, describes series "B-10" and "B-20" pneumatic spring and diaphragm operators. Shows operator in various typical combinations with butterfly valves, adjustable port valve, burner valve, etc. *Conoflow Corp., Dept. HPAC, 2100 Arch St., Philadelphia.*

▸ *PRECAST CONCRETE FOR PANEL HEATING* — Samples of how precast concrete slabs lend

PALMER

MERCURY ACTUATED
recorders

Into this modern Mercury Actuated Recorder has gone all the skill of Palmer master craftsmen.



Readings are clearer, smoother and more precise than ever thought possible. In fact readings are so amazingly improved that maintenance is never needed under normal uses.

Recording Thermometers feature twelve inch die-cast aluminum case with black wrinkle or white satin finish. Single or multiple pen construction. Electric or spring wound clock, 24 hour or 7 Day Revolution. Flexible Armor and bulb of stainless steel. Ranges —40 to 1000°F. or Equivalent in °C.

Send for Bulletin No. 45

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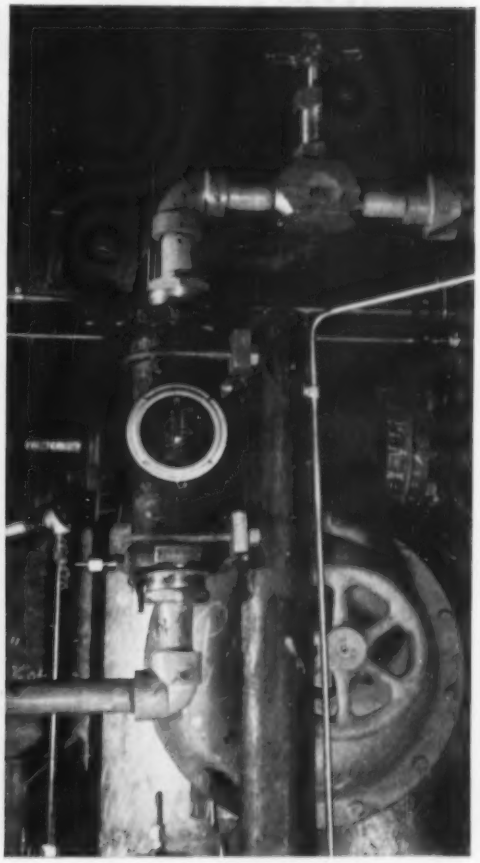

Here rigid Geon vinyl pipe is used in a demineralizer unit which treats boiler feed water. Piping handles caustic soda. View at right shows how Geon plastic pipe ties in to stainless steel valve and other metal parts. Pipe is made by National Tube; Vancor fittings by Colonial Plastics.

Unique chemical properties of Geon Rigid Vinyl Pipe

make new applications possible

FROM chemical plant piping to industrial water lines, from vent lines for acid fumes and corrosive gases to sour crude oil lines—the exceptional properties of pipe and fittings made from Geon rigid vinyls are making cheaper, longer-lasting and easier-to-install applications possible. The outstanding hows and whys include:—

- **Resistance to oils, acids, alkalis and most chemicals.**
- **High tensile and impact strength.**
- **Resistance to sunlight, fungi, bacteria, moisture, heat and cold.**
- **Smooth internal surface that reduces flow resistance.**
- **Ease of installation. Its light weight saves in freight, time, labor.**
- **It's a non-conductor—not subject to galvanic corrosion.**

These and other properties of Geon rigid vinyl pipe are helping engineers in a host of industries solve problems involving extreme operating conditions. Perhaps this remarkable material can supply the answer to your present and future problems. To find out how Geon can fit into your future, send for our new booklet on Geon 8700A and 8750. It gives detailed information about physical properties, applications and advantages of unplasticized polyvinyl chloride compounds. Just write Dept. DN-5, B. F. Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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Visible "on-off" Operation
Operating ranges from 0-14 psig to 0-300 psig with differentials varying from 2 oz. to 147. Listed as standard by UL (NEMA 1A,2,3,4.)
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Series PQ
FOR AIR OR GAS
Very sensitive.—Diaphragm Operated Available in six operating ranges from 0 to 0.1" pressure to 1 to 30" vac., with varying differentials. Has hermetically sealed contact.
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RECENT TRADE LITERATURE

Continued

themselves to use in church buildings presented in new 6 page booklet. Cited use is for installation of panel heating systems, often used for church auditoriums. *Flexicore Co., Inc., Dept. HPAC, 1932 E. Monument Ave., Dayton* 1.

▸ *PROCESS CONTROL* — Data sheet 3.0-7 describes "Gayvac" process for precooling produce without ice or conventional refrigeration, and instrumentation which controls this process. *Minneapolis-Honeywell Regulator Co., Dept. HPAC, Wayne and Windrim Aves., Philadelphia* 44.

▸ *PUMPS* — Circular No. 146A describes horizontal, forged steel cylinder, steam driven reciprocating pumps for range of heavy duty, high pressure services. Units in duplex, single styles. *Dean Bros. Pumps, Inc., Dept. HPAC, 323 W. 10th St., Indianapolis.*

▸ *PVC COMPOUNDS* — Eight page technical bulletin on rigid unplasticized polyvinyl chloride compounds "Geon 8700-A" and "8750" deals specifically with use of these compounds in manufacture of pipe and fittings. Tables summarize physical properties, tabulate series of characteristic chemical immersion test results. *B.F. Goodrich Chemical Co., Dept. HPAC, 446 Rose Bldg., Cleveland* 15.

▸ *REFRIGERATING MACHINE* — Engineering data for new hermetic centrifugal refrigerating machine presented in catalog No. 19C-100. Cited features of unit are pushbutton operation, low installation cost. In 90 to 350 ton capacities for multistory building air conditioning, industrial processing requirements. *Carrier Corp., Dept. HPAC, Syracuse, N. Y.*

▸ *REFRIGERATION UNITS* — Revised bulletin DS-399 contains information on "Duplex CenTraVacs," company's largest capacity hermetic

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SITUATIONS
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1 to 40 GPH
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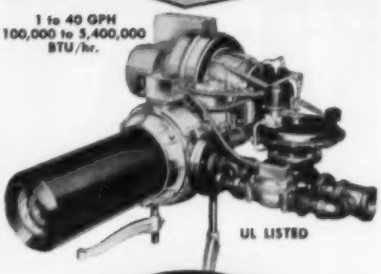

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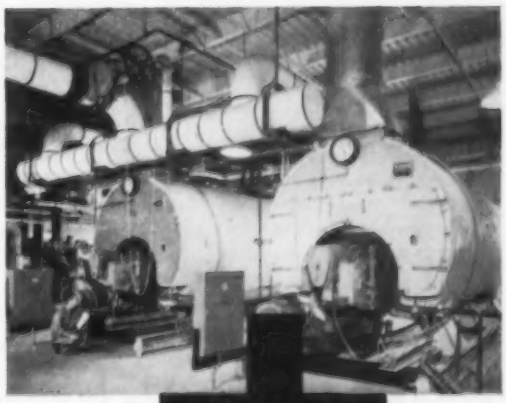

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FORGED STEEL

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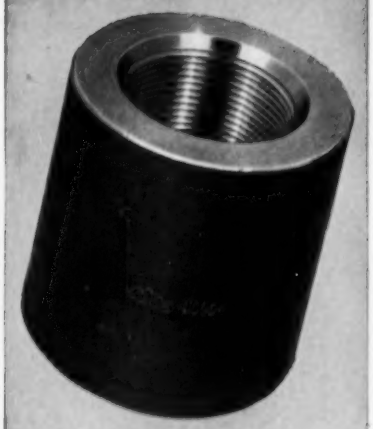

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RECENT TRADE LITERATURE

Continued

centrifugal refrigeration unit. Includes capacity tables, water pressure drop charts, engineering data. *Trane Co., Dept. HPAC, La Crosse, Wis.*

▸ *REGISTERS, GRILLES* — New 24 page catalog No. 22 contains illustrations, specification tables, dimensional drawings for company's lines of registers, grilles, ventilators, dampers, vanes, shutters. Features new "Alumitint" register designed for air conditioning. *Register & Grille Mfg. Co., Inc., Dept. HPAC, 70 Berry St., Brooklyn 11.*

▸ *ROOF VENTILATORS* — Revised catalog, bulletin A-112A, covers line of roof ventilators. Sizes, specifications, performance data, dimensional drawings included. Features new reversible unit. *Hartzell Propeller Fan Co., Dept. HPAC, Piqua, Ohio.*

▸ *SCALE, CORROSION PREVENTATIVE* — New 8 page bulletin details principle, operation, types of units of "Cepi-Comav" apparatus designed for treatment of liquids to prevent scale, corrosion. Literature includes photographs, specification tables. *Cepi-American, Inc., Dept. HPAC, 7001-3 North Ave., Oak Park, Ill.*

▸ *SHEAVES* — "*Ful-Grip Q-D*" sheaves, standard "Multi-V" sheaves, special made-to-order sheaves for multiple v-belt drives covered in catalog. Literature gives practical information on handling, as well as dimensions, descriptions. *Maurey Mfg. Co., Dept. HPAC, 2915 S. Wabash Ave., Chicago 16.*

▸ *SMOKE DENSITY ALARMS* — Types "Z" and "PIX" smoke density alarms described in bulletins 107-F and 106-F, respectively. *Reliance Instrument Mfg. Corp., Dept. HPAC, 190 Glen Cove Ave., Glen Cove, L. I., N. Y.*

▸ *SMOKE DENSITY INDICATOR* — Details of "Fireye" smoke density

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in Protecting Pipe and Pipe Joints Against Corrosion

Let TAPECOAT® do the job without Kettles, Hot Stuff, or Special Crews

When specifications call for hot applied coal tar protection of underground piping as in AWWA specifications C-203 and C-204, and the volume does not justify the cost of shipment to a mill for coating—TAPECOAT offers a practical solution. Here is a widely-accepted alternate material that is equivalent to mill-applied hot coal tar protection.

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By Peter J. Joyce

"When I was a young salesman in 1935, sometimes our troubles just started after we sold the job," says Mr. Joyce, owner, Joyce Refrigeration & Equipment Co., Pittsburgh, Pa. "For example, the refrigerants most commonly used then were dangerous, inefficient, or they created service problems. Today, we use 'Freon'* refrigerants on all our installations and can just about stop worrying on the job and after. I estimate we save thousands of dollars a year on equipment and labor because of the trouble-free performance of 'Freon' refrigerants.

"We make from 200 to 250 refrigeration and air conditioning installations a year in supermarkets, dairies and meat stores," continues Mr. Joyce. "'Freon' does an excellent job on all our work. We've *never* had a corrosion problem, and we've *never* had any moisture trouble. We use 'Freon' because we don't have to worry about it."

You can stop worrying about refrigerants if you ask your wholesaler for Du Pont "Freon" whenever you have an air conditioning or refrigeration job to do. Reciprocating, rotary or centrifugal compressors; household, commercial or industrial applications—there's a "Freon" refrigerant ideally suited to your installation. "Freon" is your best refrigerant buy, because it's pure, dry and safe—just as it has been ever since Du Pont started making it 25 years ago. Be sure to ask your wholesaler for dependable Du Pont "Freon" refrigerants.

Want more information or technical data on uses of "Freon"? Write to E. I. du Pont de Nemours & Co. (Inc.), "Kinetic" Chemicals Division 00, Wilmington 98, Delaware.

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SAFE REFRIGERANTS

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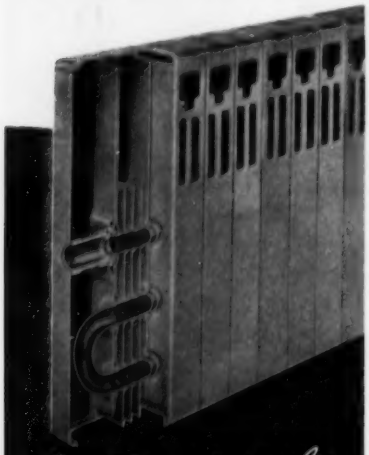
2 kinds of heat

RADIANT and CONVECTED

from SHAW RADIATORS



always *properly* distributed in the room!

Shaw Radiators "heat-condition" a room for *natural* comfort by delivering *radiant* heat that warms solid objects, and *convected* heat to warm the atmosphere.

This AIR-e-ATED Radiant Heat, exclusively Shaw's, is distributed in unvarying, health-guarding proportions that only Nature—*at her best*—can rival.

AIR-e-ATED Radiant Heat is the result of Shaw's fully self-contained construction, featuring full length steel heating fins and exterior radiant panels *all tightly bonded to the copper heating coils*. Shaw units—panel or baseboard—are but 3" thick, easily handled and installed. Choice of same end or opposite end tapping permits simplified piping, lower piping costs. Hot water or steam may be used up to 150 psi.

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RECENT TRADE LITERATURE

Continued

indicator system "FE-3" presented in new 4 page bulletin CM-22. Illustrated with photographs and drawings, literature gives operating and specification data. *Electronics Corp. of America, Dept. HPAC,* 718 *Beacon St., Boston* 15.

▸ *SOLENOID VALVES* — New 32 page condensed valve catalog No. 201 includes latest designs in company's two-, three-, four-way solenoid valves. Contains engineering information, flow charts, operation and construction details, illustrations prices, etc. *Automatic Switch Co., Dept. HPAC,* 391 *Lakeside Ave., Orange, N. J.*

▸ *STEAM HEATING CONTROLS* — Company's moderator system of steam heating control system detailed in 16 page bulletin. Includes descriptions, diagrams and specifications, illustrated case histories. *Warren Webster & Co., Dept. HPAC, Camden* 5, *N. J.*

▸ *STEEL — The Elevated Temperature Properties of Full Hard Type* 301 is 4 page bulletin containing table, charts covering subject. *Allegheny Ludlum Steel Corp., Dept. HPAC, Oliver Bldg., Pittsburgh* 22.

▸ *THERMOMETERS* — Bulletin 148 cites features of company's "Every Angle" bimetal thermometers. Includes ranges, catalog numbers, stem lengths, list prices, specifications, dimensional drawings. *Manning, Maxwell & Moore, Inc., Dept. HPAC, Stratford, Conn.*

▸ *THERMOMETER WELLS* — Data sheet No. 6561 covers construction features and specifications, use facts, illustrations of three main types of company's double-bore "Thermowells." Variations available to meet specific requirements covered. *Trinity Equipment Corp., Dept. HPAC,* 472 *Westfield Ave., E., Roselle Park, N. J.*

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Contractors cut installation costs with vinyl-faced Super·Fine Duct Wrap

To assure thermal-insulating efficiency and an effective vapor barrier at reduced installation costs, Theodore Rogvoy (A.I.A.) and David J. Zabner (M.E.) selected vinyl-faced Super·Fine insulation to wrap cold-air ducts in Detroit's Eastgate Shopping Center.

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- light weight!
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- easy to cut with an ordinary knife or scissors!
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- economical to store—compressed rolls save space, yet insulation springs back to its full thickness!

Super·Fine is available with vinyl and other plain or reflective facings, extended beyond edges of insulation to form tabs. For complete information, check your Yellow Pages for the nearest distributor, or write: L·O·F Glass Fibers Company, Dept. 39-96, 1810 Madison Avenue, Toledo 1, Ohio.

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SUPER·FINE INSULATION

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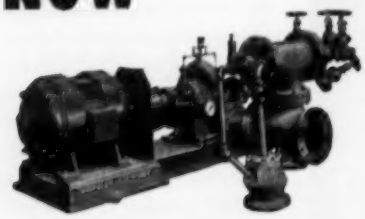

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A delay in the planning or completion of your fire protection program may mean loss of life, property or operation. For a complete and effective plan include one or more Underwriters Laboratory and Factory Mutual Fire Insurance Companies approved Wheeler-Economy Fire Pumps.

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RECENT TRADE LITERATURE

Continued

▸ *THERMOSTATS* — Condensed catalog MC-120B lists physical, electrical, preformance specifications for types of snap-action, locally-adjustable themostats. Describes assortment of head styles, snap switches, electrical ratings, temperature ranges, modification. *Fenwal, Inc., Dept. HPAC, Ashland, Mass.*

▸ *THERMOSTATS* — New 4 page bulletin 8400 covers all thermostats in "Stemco" line. Gives information on temperature ranges, ratings, mountings, terminal arrangements. Also included is temperature conversion chart. *Stevens Mfg. Co., Inc., Dept. HPAC, P. O. Box* 1007, *Mansfield, Ohio.*

▸ *THERMOSTATS* — Physical, electrical performance data required for specifying several types of company's miniaturized thermostats and surface mounted thermostats presented in 4 page catalog MC-124A. Includes summary of design, installation factors which can affect accuracy, regardless of type of temperature controller involved. *Fenwal, Inc., Dept. HPAC, Ashland, Mass.*

▸ *TRANSMITTING POTENTIOMETERS* — New bulletin MTT810 includes description, applications, principles of operation, design and operating specifications, standard temperature ranges, standard voltage ranges for company's transmitting potentiometer pyrometer, transmitting potentiometer millivoltmeter. *Manning, Maxwell & Moore, Inc., Dept. HPAC, Stratford, Conn.*

▸ *UNIONS* — Brochure describes features of bronze-to-bronze seat "Dart" malleable iron unions. Contains illustrations of unions, union fittings. *Fairbanks Co., Dept. HPAC,* 393 *Lafayette St., New York* 3.

▸ *UNIT HEATER* — New 36 page product bulletin cites specifications,

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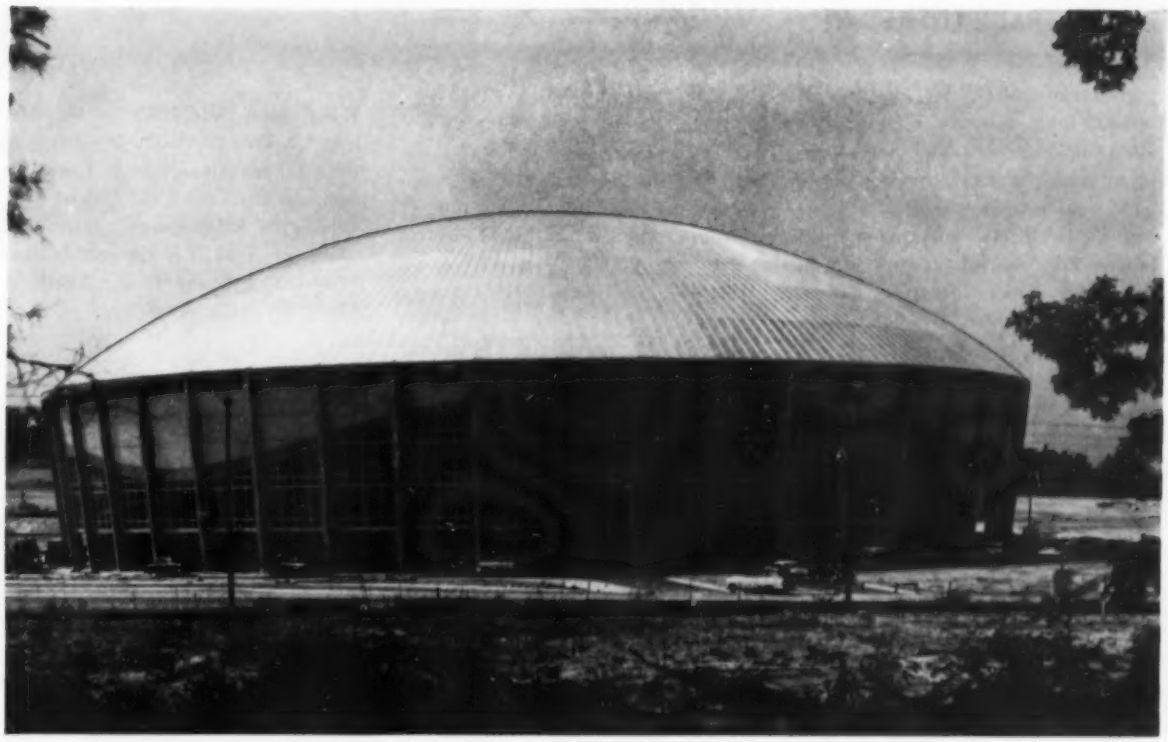

Marlo Heats and Ventilates Huge New Coliseum

Comfort conditioning the cavernous interior of this new 13,500-seat coliseum in Charlotte, N. C., is a man-size job. The huge aluminum dome, easily the world's largest at more than 332 feet in diameter, covers an area of two acres.

Heating and ventilating this unusual structure is accomplished by 22 Marlo Ceiling Units, with a combined capacity of 336,800 cubic feet per minute.

The building was designed by architect A. G. Odell, Jr. General contractor was Thompson & Street Co., mechanical contractor was Hopkins, Hicks and Ingle, and engineer was Mechanical Engineers, Inc., all of Charlotte.

One of the 22 Marlo heating and ventilating units suspended from the roof structure of the new coliseum.

Consult your Architect or Engineer—or write today for more detailed information on these and other Marlo Air Conditioning Units.

MARLO coil co.

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Quality Air Conditioning and Heat Transfer Equipment Since 1925

RECENT TRADE LITERATURE

Continued

performance data for horizontal, vertical unit heaters. Bulletin No. 700A includes hot water and steam performance tables, dimensions, selections, applications, descriptions of cabinets, elements, motor mountings, fans and accessories, controls. *American Air Filter Co., Inc., Dept. HPAC,* 215 *Central Ave., Louisville.*

▸ *V-BELT CLUTCH* — Bulletin ROL-1255 describes v-belt clutch said to have unique principle of operation. Photographs, drawings, schematic drawings illustrate clutch parts, explain operating principle. Specifications, characteristics included. *Rev-O-Loc Clutch Corp., Dept. HPAC, P. O. Box* 1806, *Milwaukee* 1.

▸ *VACUUM, PRESSURE GAGES* — Design features, illustrations, diagrams of company's vacuum and pressure gages presented in 4 page folder, catalog No. 140. Optional accessories listed. *Hastings-Raydist, Inc., Dept. HPAC, Hampton, Va.*

▸ *VALVES* — New 8 page condensed catalog 56C covers line of pressure, temperature, level control valves for automatic process control. Described are wide range of reducing valves, pump governors, relief valves, temperature regulators, feedwater regulators, float valves, damper regulators, combustion control valves for heating, chemical processing, power generation, other industrial applications. *Atlas Valve Co., Dept. HPAC,* 280 *South St., Newark* 5.

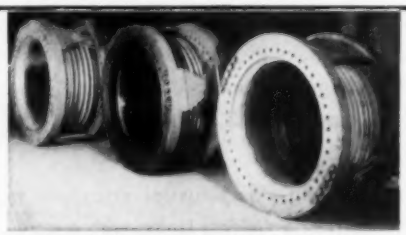
▸ *VALVES* — Line of spring loaded, piston operated, internal pilot actuated steam pressure reducing valves described in 6 page handbook BV-56. Booklet offers details on design, operating characteristics, function, application for units. *Atlas Valve Co., Dept. HPAC,* 280 *South St., Newark* 5.

▸ *WELDER MOTORS* — Application bulletin AB-510-B discusses design, cites advantages and uses for company's "Linc-Weld" motors. Highlights "Multiguard" feature of units, tells how it is applied. *Lincoln Electric Co., Dept. HPAC,* 22801 *St. Clair Ave., Cleveland* 17.

▸ *WELDING* — New 28 page bulletin SB-1352 is welding directory for stainless steels, nonferrous metals, cast iron, manual hardsurfacing. *Lincoln Electric Co., Dept. HPAC,* 22801 *St. Clair Ave., Cleveland* 17.

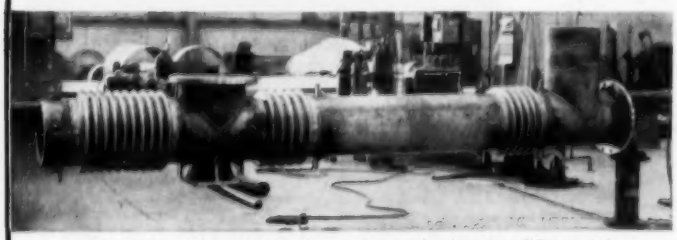
▸ *WELDING* — Power sources for welding applications described in bulletin SB-1358. Covers various units in company's line. Includes specifications, dimensional drawings. *Lincoln Electric Co., Dept. HPAC,* 22801 *St. Clair Ave., Cleveland* 17. ⫩

ADSCO



Three 48" Hinge-Type Corruflex Expansion Joints

ENGINEERING BACKS UP EVERY CORRUFLEX PACKLESS EXPANSION JOINT

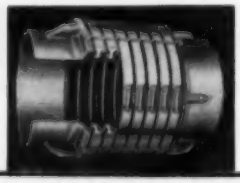


Complex stainless steel assembly of piping and joints absorbing four different motions

Regardless of size or degree of complexity of the joint involved, ADSCO applies its vast engineering experience to every piping problem presented to it. The help ADSCO provides not only makes the customer's piping react the way it should but also saves money in both installation and maintenance costs. Next time consult ADSCO, a leader in the development of maintenance-free packless expansion joints.

• *Write for Bulletin 35-51.*

Basic Corruflex Joint with Equalizing Rings



AMERICAN DISTRICT STEAM DIVISION
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MARSH PACKLESS RADIATOR VALVES

WHEEL HANDLE

GRADUATED

LOCK AND SHIELD

ANGLE PATTERN

GLOBE PATTERN

CORNER PATTERN (Sectional Below)

MARSH THERMOSTATIC RADIATOR TRAPS

ANGLE PATTERN

STRAIGHTWAY PATTERN

VERTICAL PATTERN

LEFT HAND CORNER PATTERN

RIGHT HAND CORNER PATTERN

CUT OPEN VALVE

F&T TRAPS

No. 12, REPRESENTATIVE OF WIDE LINE

VENTS

No. 5 VENT, ONE OF MANY

BUCKET TRAPS

No. 500 INVERTED BUCKET TRAP

All the best of their kind!

You probably have made certain Marsh products your standbys without realizing there are a lot more of them just as superlative as the ones you like so well.

Make the acquaintance of some of them here, but, better still—***Ask for this Marsh Catalog!***

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THER-ALTI-METER (Square and Round)

INTERNAL SYPHON (Square and Round)

OUNCE-GRADUATED RETARD (Also Compound)

STANDARD (Also Compound)

WHO'S WHAT . . .

(New personnel, promotions)

▸ *INDUSTRIAL PLASTIC FABRICATORS, INC.*—James P. O'Connor, Jr., sales manager.

▸ *CARRIER CORP.*—M. Everett Barnard, manager of unit heater department.

▸ *MUELLER CLIMATROL*—Frank J. Nunlist, executive vice president; H. P. Mueller, Jr., vice president in charge of sales.

▸ *TEXAS ASSOCIATION OF CONSULTING ENGINEERS*—Officers for Dallas-Ft. Worth chapter are: Leo Landauer of Landauer and Shafer, president; R. S. Smith, vice president; Arnold Gaynor of Gregerson and Gaynor, secretary treasurer. H. G. Gregerson of the firm is president of the North Texas chapter of ASHAE. Ross Zumwalt of Zumwalt and Vinther is secretary of that chapter and was first president of the Dallas-Ft. Worth chapter.

▸ *DODGE MFG. CORP.*—Donald Saunter, director of production and purchasing.

▸ *BARBER-COLMAN CO.*—H. H. Kieckhefer, sales manager of Wheelco Instruments Div.

▸ *CRANE CO.*—Warren A. Logelin, director of public relations. He succeeds Russell G. Creviston, retired.

▸ *OLIN MATHIESON CHEMICAL CORP.*—J. E. Williams, vice president and general manager of Western Brass Mills Div.; John B. Seastone, director of technical division.

▸ *PERFECTION INDUSTRIES DIV., HUPP CORP.*—Carl W. Millsom, vice president in charge of sales and advertising.

▸ *AMERICAN GAS ASSOCIATION*—Allen D. Schrodt, director of promotion, advertising and research.

▸ *AMERICAN SOCIETY OF MECHANICAL ENGINEERS*—Nominations for 1956-57 are: president—William F. Ryan, vice president, director and senior consulting engineer of Stone & Webster Corp.; technical director—Eugene W. Jacobson, chief design engineer, Gulf Research & Development Co.; administrative director—V. Weaver Smith, vice president in charge of contracts, Lummus Co. Nominated for four regional vice presidencies are: Region II—William H. Byrne, president and chairman of the board, Byrne

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KNO-DRAFT SLOTTED AIR DIFFUSERS: handsome extruded aluminum in modules of 2, 3, 4 or 6 feet. Install singly or butted in series to form continuous diffuser line on wall or ceiling. Adjustable one-directional flow for small areas; multi-directional flow for larger areas. Exclusive Kno-Draft adjustable air direction vanes. Grid-type volume control. Damper grids equalize air distribution over length of diffuser.

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X-ray and gamma ray inspection—examining the very structure of the metal itself—are two of the many ways that Powell can make absolutely certain that Powell Valves will give *dependable* flow control.

Every part of every valve must pass rigid inspection. As a final step in manufacture, every Powell Valve is subjected to *an actual line test.* Because of Powell's pains-taking quality control, valve repair is cut to the minimum and plant shut down through valve failure is substantially reduced. Records from refineries, power and industrial plants the world over prove it.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our COMPLETE *quality line* which has PERFORMANCE VERIFIED.

The Wm. Powell Company, Cincinnati 22, Ohio . . . 110th YEAR

PERFORMANCE PV VERIFIED

FIG. 375—Bronze Gate Valve for 200 Pounds W.S.P.

FIG. 2608—Bronze Full Flow Globe Valve for 200 Pounds W.S.P.

FIG. 1503—150-Pound Steel Gate Valve.

POWELL VALVES

BRONZE, IRON, STEEL AND CORROSION RESISTANT VALVES.

WHO'S WHAT

Continued

Assoc., Inc.; Region IV—James H. Sams, dean of engineering, Clemson College; Region VI—Rolland S. Stover, owner R. S. Stover Co.; Region VIII—Clifford H. Shumaker, chairman, department of industrial engineering, Southern Methodist University.

▸ *A. O. SMITH CORP.*—W. W. Higgins, chief engineer on the staff of the executive vice president.

▸ *PACKLESS METAL HOSE, INC.*—Murry B. Johnson, sales manager.

▸ *WORTHINGTON CORP.*—Frederick B. Seel, assistant manager of engineering at Holyoke Div.

▸ *WATER SERVICE LABORATORIES, INC.*—William J. Ryan and Morris Rosenfeldt, vice presidents.

▸ *JOHN WOOD CO.*—R. R. Allen, vice president and director of engineering and research.

▸ *FRIGIDAIRE DIV., GENERAL MOTORS CORP.*—Herman F. Lehman, General Motors vice president and head of Frigidaire Div. Formerly general sales manager of Frigidaire, Mr. Lehman succeeds Mason M. Roberts, retired.

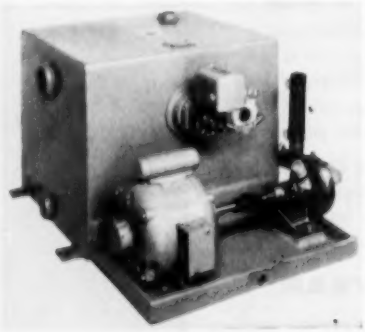
▸ *ROCKWELL MFG. CO.*—Russell L. Sylvester, chief engineer of central valve research and development department; Weldon D. Wiles, assistant to president of Rockwell's recently acquired locomotive finished material division.

▸ *CARRIER CORP.*—Dr. Philip P. Anderson, director of development in absorption refrigeration; Leonard J. Rogan, quality control superintendent for company's Day & Night and Payne Divs.

▸ *ATLAS VALVE CO.*—Fritz G. Klein, field engineer.

▸ *MUELLER BRASS CO.*—Robert L. Gibbs, general sales manager.

▸ *INGERSOLL CONDITIONED AIR DIV., BORG-WARNER CORP.*—George E. Bosch, charge of sales and product development for air distribution and diffuser program; Lawrence J. Hoogheem, works accountant and credit manager.



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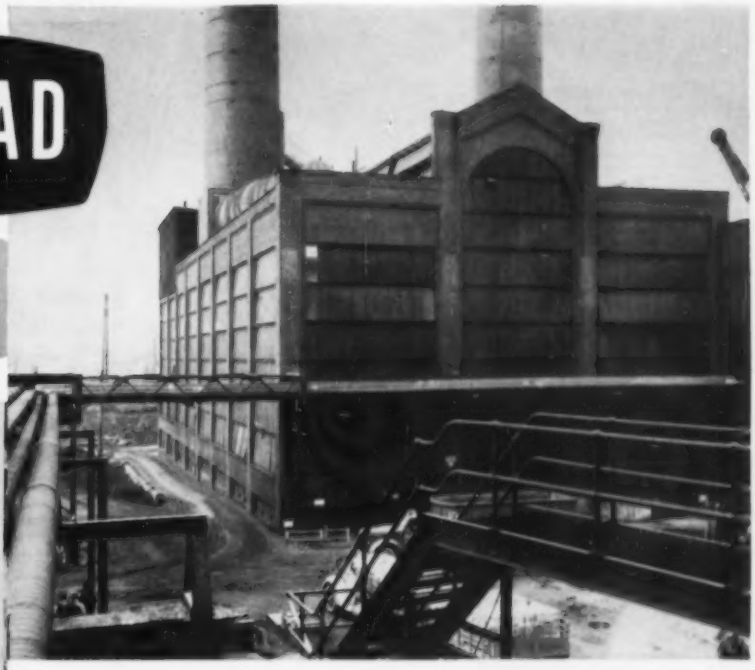

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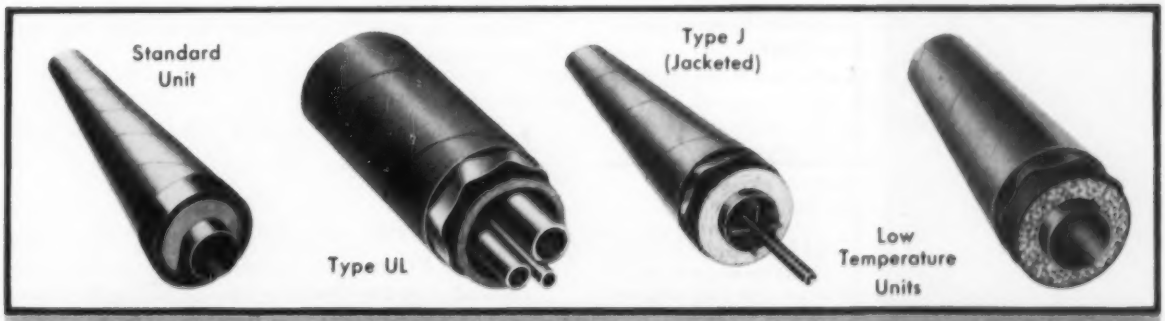
Ric-wiL factory prefabricated piping systems, *timed* to your schedule and *shipped* directly to the job site, can save you valuable time and money. Insulated units are available for steam, hot water, oil, other viscous fluids, process liquids and refrigeration lines . . . and remember . . . Ric-wiL is the quality system of exceptionally high mechanical strength and thermal efficiency.



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. . . of Exceptionally High Thermal Efficiency

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PREFABRICATED INSULATED PIPING SYSTEMS
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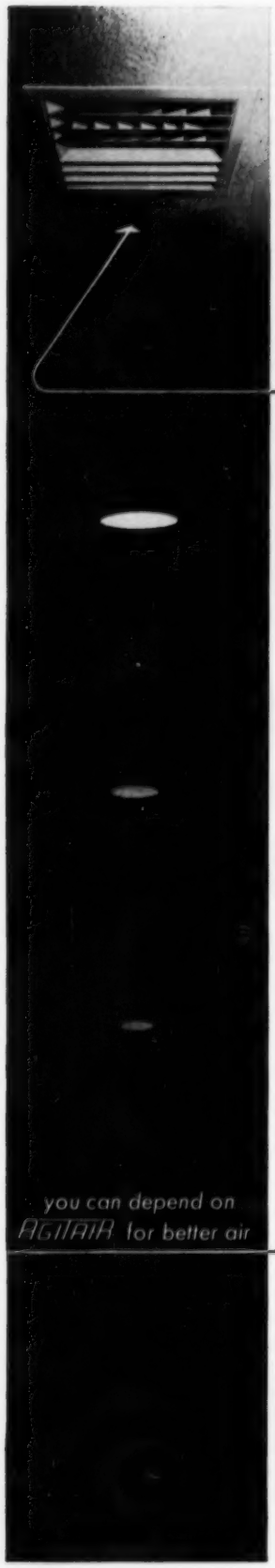

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WHO'S WHAT

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▸ *L. O. F GLASS FIBERS CO.*—Fred W. Segerstrom, general sales manager of general products division.

▸ *WATER SERVICE LABORATORIES, INC.*—Henry Robins, executive vice president.

▸ *OLIN MATHIESON CHEMICAL CORP.*—G. N. Stuart, production manager of brass strip operations at Western Brass Mills division.

▸ *ROBERTSHAW-FULTON CONTROLS CO.*—Charles D. Branson, assistant director of research.

▸ *POWERS REGULATOR CO.*—Kenneth M. Stevens, director. Mr. Stevens is vice president and central division manager of the company.

▸ *RUUD MFG. CO.*—V. J. Plouffe, technical assistant to R. N. Spear, sales manager.

▸ *GENERAL ELECTRIC CO.*—R. H. Jones, general manager of air conditioning division.

▸ *PENN CONTROLS, INC.*—Max A. Coreth, manager of newly established export division.

▸ *HARVEY ALUMINUM*—Leo M. Harvey, lauded by the American Legion for his contributions to the nation's industrial growth. Mr. Harvey is president of the company bearing his name.

▸ *ROCKWELL MFG. CO.*—Gilbert T. Bowman and J. W. Northcutt, assistant vice presidents. Jack H. Walters succeeds Mr. Northcutt as southern regional sales manager.

▸ *SQUARE D CO.*—Sager T. Colman, export manager; John E. Rapier, export office manager.

▸ *EXCELSIOR STEEL FURNACE CO.*—Irving Brex and Everett Brex, transferred to company's Chicago office to assist in sales administration. Both have been with the Brex Div. in Ridgewood, N. J.

▸ *H. K. PORTER CO., INC.*—Lawrence L. Garber, vice president in charge of production; Eugene Salinger, general manager of company's Henry Disston Div., succeeding Mr. Garber in that capacity.

Even your tricky pipe racking is easier with UNISTRUT® channel

Typical service tunnel in large Midwest university

You make more money with UNISTRUT channel, too—by saving time, men and materials on this foolproof, superior method of pipe racking.

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WHO'S WHAT

Continued

▸ *AIR POLLUTION CONTROL ASSOCIATION*—Benjamin Linsky, president. Mr. Linsky, chief of the smoke abatement bureau, City of Detroit, succeeds H. Kenneth Kugel, chief engineer, division of smoke regulation and boiler inspection, Washington, D. C.

▸ *A-P CONTROLS CORP.*—Delmar Moerick, elected to board of directors of Air-Conditioning and Refrigeration Institute. Mr. Moerick is vice president, sales, for A-P Controls. Remy Ludwig has been appointed vice president of the international division of Controls Co. of America, A-P Controls' parent company.

▸ *PRESBYTERIAN-ST. LUKE'S HOSPITAL, Chicago*—John W. Holbrook, administrative engineer.

▸ *HUCK MFG. CO.*—Robert H. Butt, manager of field engineering department.

▸ *EDWARD VALVES, INC.*—Arnold S. Grot, chief metallurgist.

▸ *NATIONAL-U. S. RADIATOR CORP.*—Stanley F. Korol, industrial designer, to be active in design phases of heating and air conditioning equipment.

▸ *SOCIETY OF AMERICAN MILITARY ENGINEERS*—William T. Smith, winner of the society's Newman Medal award for 1955. Mr. Smith is chief of the refrigeration and air conditioning section of the Office of the Assistant Chief of Staff, Installations, U. S. Air Force.

▸ *CONOFLOW CORP.*—John C. Koch, president of Fluid Controls Institute, Inc. Mr. Koch is vice president and general manager of Conoflow. Robert W. Stanton, Jr., has been named advertising manager for the company.

▸ *CONTROLS CO. OF AMERICA*—Phil Starbuck, director of industrial relations.

▸ *VAPOR HEATING CORP.*—Arthur J. Loose, vice president.

▸ *ARTHUR D. LITTLE, INC.*—William A. W. Krebs, Jr., vice president.

▸ *CRANE CO.*—Robert E. Penney, director of branches; Charles H. Lovelace, manager of valve and fitting sales.

Giant Snow Melting System for Staten Island Ferry Building features "*snowless*" stairway

Snow melting coils in place on stairway forms . . . and freshly concreted stairway. Handrails to be installed later.

Architectural Designers & Engineers: Roberts & Schaefer, New York, N. Y.
Consulting Engineer: Mongitore & Moesel, New York, N. Y.
Mechanical Contractor: Raisler Corporation, New York, N. Y.
Pipe Fabricator: Atlantic Pipebending & Fabricating Corp., Wood-ridge, N. J.

Reconstruction of the Manhattan Terminal of the Staten Island Ferry, operated by New York City's Dept. of Marine and Aviation, includes an extensive snow melting system. The long curving ramp, which starts at street level and expands into a semi-circular walkway on the second level, is completely fitted with snow-melting coils, as are the walkways.

A unique feature of the installation is that an open stairway from the street to the top of the ramp has also been equipped with snow-melting coils—one length of 1" pipe in the tread of each step.

Approximately 14 tons of 1" NATIONAL Steel Pipe were used in the grids, and about 5 tons of sizes up to 3" were employed as headers, connecting pipes, etc.

Architects, engineers, and contractors have been specifying USS NATIONAL Steel Pipe for over 60 years as the "standard" choice for conventional plumbing and heating systems.

The inherent characteristics of NATIONAL Pipe are well known—smooth, uniform bending; sound, strong welding properties; and extra-long service life—characteristics that make NATIONAL Pipe ideal for such applications as snow melting and radiant heating, and give it the reputation for dependability that it enjoys. Such a well-deserved reputation inspires confidence—a nation-wide confidence that has made USS NATIONAL Pipe the largest selling pipe in the world. Write for free descriptive literature.

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USS NATIONAL PIPE

UNITED STATES STEEL

WHO'S WHAT

Continued

▸ *WAGNER ELECTRIC CORP.*—P. C. Ford, director of all electrical and automotive engineering and research facilities. Mr. Ford is newly appointed executive engineer.

▸ *CHARLES D. SIMKIN & SONS, INC.*—Samuel F. Simkin, appointed to the subcommittee of pipeline design, specifications and operating standards for American Society of Civil Engineers. Mr. Simkin is treasurer and assistant secretary of Charles D. Simkin & Sons.

▸ *COPELAND REFRIGERATION CORP.*—E. R. Boynton, chief engineer; Dale H. Bodine, manager of educational services.

▸ *DRAYER-HANSON, INC.*—Barry T. Benson, international sales representative.

▸ *LESLIE CO.*—Elected to company's sales management board are: S. E. Abernathy, chairman; John N. Fehlinger, vice chairman. New members to that board are Charles J. Brogan, Arthur G. Kerr, Lowell F. Jett, Edgar S. Stem.

▸ *INTERNATIONAL NICKEL CO., INC.*—William F. Burchfield and Kenneth M. Spicer, supervisor and assistant supervisor, respectively, of technical service in company's development and research division; Dr. W. A. Mudge, special representative of educational programs.

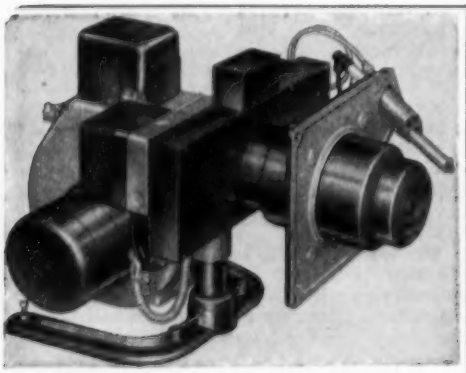
▸ *ARMSTRONG CORK CO.*—William J. Watkins, assistant economist in office of economic and commercial research.

▸ *BURGESS-MANNING CO.*—Allen Wilson, a vice president; Dudley W. Day, a director.

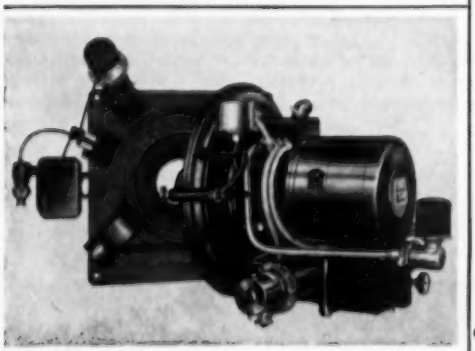
▸ *JOY MFG. CO.*—John P. Cartwright, manager, industrial sales; William Hanson, Jr., manager of conveyor products, new Philadelphia plant.

▸ *DRAVO CORP.*—Walter P. Barrett, manager of pipe fabrication department of company's machinery division.

▸ *BLACK & DECKER MFG. CO.*—John P. Spain, manager of new service sales division. The division will be in operation by October 1, the company announces.



BANKHEAT DUAL-FUEL, Pressure Type, 5 to 54 H.P.



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25 to 500 H.P.

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These burners are available in Domestic, Commercial and Industrial sizes and types. All are completely automatic and equipped with the finest electronic controls. They are engineered, tested and precision-built to give lasting service and satisfaction. See them at your nearest Johnson dealer, or write direct.

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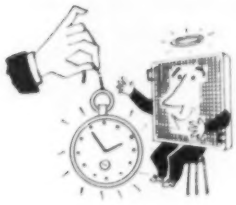
Random Thoughts from a Filter Engineer

by James Stahn, Sales Engineering Department

- **WHICH OF YOUR AIR FILTERS DESERVE A GOLD WATCH?**
- **THE AIR FILTER BUSINESS MUST BE PROFITABLE!**
- **FAST MAN WITH A GUN CAN BE DEATH ON FILTERS**

WHICH OF YOUR AIR FILTERS DESERVE A GOLD WATCH?



Don't laugh, many people today are robbing themselves...blind. They're paying out good, hard cash for filtering air . . . but getting short changed.

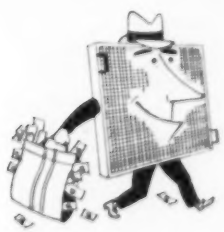
As a filter manufacturer, we keep an eye on what goes on in our industry. It's surprising what turns up. For example, over half the filters in use today are ten years and older. In fact, we often come across filter panels bought before World War II. And that's at least 15 years ago.

True, a good filter is like a good car. Take care of it and it could last forever. That's why some filters are in as good condition today as when they were first built. But frankly, many, many filters that appear to be in good shape should be given a gold watch and retired! Why? Because in the past decade, giant strides have been taken in filter design—advances that make today's filters vastly more efficient than those of yesteryear. So, if you don't have the most modern filter units available, chances are the ones you have are actually costing you more money than it would take to replace them.

On the other hand, of course, are obvious, visible reasons for retiring filters. Your filters may have rusted out because the proper adhesive hasn't been used. Or they may have been dropped or bent so that they can't seal properly. All of which adds up to dirt and dust leaking through that you're shelling out good money to filter.

Better take a minute to check your filters for signs of old age. Maybe you're one who is paying for new filters every day. Our representative will be glad to help you check. Why not give us a call—today?

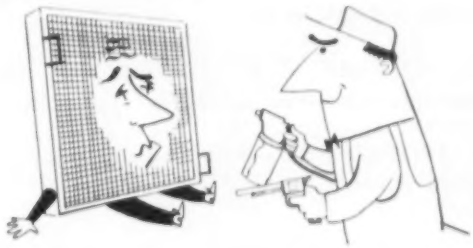
THE AIR FILTER BUSINESS MUST BE PROFITABLE!



At least that should be your impression, based on the large number of new filter manufacturers springing up. We heard of three new ones last week!

We wouldn't be honest if we said we were pleased. However, we know increased competition is inevitable and it spurs the entire industry to make better filters.

The important point we would like to make is that there is no substitute for experience in the filter business. During the last 31 years, there are few problems we have not encountered. Many of them we have solved. This background and know-how is a part of every Air-Maze filter you buy. Occasionally our filters may cost a little more (the best usually does), but you can be sure they are thoroughly field-proven in many thousands of applications.



FAST MAN WITH A GUN CAN BE DEATH ON FILTERS

All of us like the "eager beaver" especially when maintenance costs are so darn important. But here's a case when being "penny-wise" turns out to be "pound-foolish".

One of our men was called in to find out why a filter wasn't filtering. All the impingement-type filters were clean and clamped tightly in place. There were no leaks for air to by-pass the panels. Yet the evidence showed that dirt was getting through.

After going through the system with a fine-tooth comb, our man noticed one "eager-beaver" renewing the adhesive on filter panels. Instead of following the service procedure the manufacturer specified, the maintenance man thought he was saving a lot of time by spraying on the adhesive. Well he was, and if this wasn't bad enough, he was giving the panel the lick-and-a-promise treatment to save adhesive.

What happened? Only the outside of the filter got coated. As you'd expect, the inside was bone dry allowing most of the dirt to pass right through. No wonder the filter wouldn't filter.

The object lesson, of course, is that regardless of whose filters you use, follow the manufacturer's instructions to the letter. He's gone through all the possible troubles before and knows what is takes to insure the best filtering job. The Air-Maze Corp., 25000 Miles Road, Cleveland 28, Ohio.

AFI MEMBER

AIR-MAZE

The Filter Engineers

AIR FILTERS • SILENCERS • SPARK ARRESTERS
LIQUID FILTERS • OIL SEPARATORS • GREASE FILTERS

WHO'S WHAT

Continued

▸ *PHILCO CORP.*—Promotions within appliance division include: Harold W. Schaefer, vice president; Jack Cherry, manager of air conditioning department; Owen Klepper, merchandising manager; H. W. Schulze, manager of engineering services.

▸ *SERVEL, INC.*—Robert D. Eskew, chief engineer for "all-year" air conditioning division; Clyde E. Ploeger, a similar appointment for commercial refrigeration division.

IN THE TERRITORIES . . .

(Recent sales appointments)

▸ *FISHER GOVERNOR CO.*—Fred Crabbe and Jerry Stebbins, sales representatives for New York and surrounding territory. Their organization will be known as Crabbe & Stebbins Co.

▸ *YORK CORP.*—B. W. Steinkuller, Pacific district manager of commercial operations.

▸ *FAIRBANKS CO.*—John E. Bates, New England branch manager.

▸ *YORK CORP.*—Robert G. Werden, north Atlantic district manager.

▸ *GRAVER WATER CONDITIONING CO.*—William A. Homer, district manager of newly established sales-service office in Boston. The office will service the New England area.

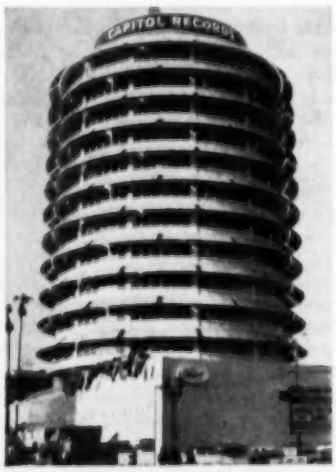
▸ *SPORLAN VALVE CO.*—Floyd B. Watts, added to field sales organization to expand coverage in Texas, Oklahoma, Arkansas, Louisiana area.

▸ *PACIFIC STEEL BOILER DIV., NATIONAL-U. S. RADIATOR CORP.*—Du-Ross Anderson Co., representative for the division in eastern Pennsylvania.

▸ *LIMA ELECTRIC MOTOR CO.*—Anthony N. Pellegrini, head of new branch office at Detroit, which will handle original equipment sales in that area.

▸ *GARDNER-DENVER CO.*—J. A. Caverly, manager of new district sales and service office at Winnipeg for Gardner-Denver Co. (Canada), Ltd.

▸ *J. F. PRITCHARD & CO. OF CALIFORNIA*—R. A. Darling, representative for Colorado, Wyoming, western South Dakota, western Nebraska.



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Capitalize on

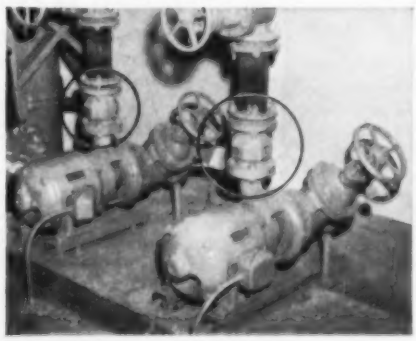
MILLER Streamflow CHECK VALVES

Completely Silences your piping system! CENTER-GUIDED, SHOCK PROOF, NOISELESS, ELIMINATES WATER HAMMER. FULL RADIAL FLOW.

SIZES 1" THROUGH 24".

FLANGED, ASA DRILLING, IBBM, CAST STEEL, ALL ALLOYS. FOR ALL FLUIDS AND GASES.

CERTIFIED MINIMUM PRESSURE DROP CURVE AVAILABLE



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MILLER VALVE CO., INC.

P.O. Box 1255—Pittsburgh 30, Pa. Plant—1620 Pennsylvania Ave.

This One is *100%* Efficient on Chickens — but *0%* on Mice!

SO — when you compare filter efficiencies, use the same test

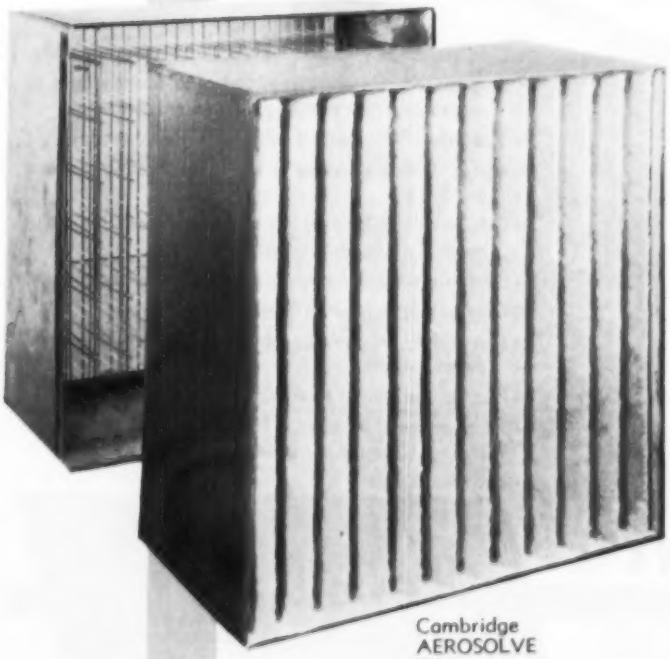
STANDARD TESTS — PERCENTAGE OF EFFICIENCY

TYPE FILTER	ASHAE (Weight Test)	NBS TEST # (Atmospheric Dust)	DOP TEST (0.3 Micron Smoke)
Cambridge Absolute	*	*	**99.95 Min.
Cambridge Aerosolve 95	*	90-95	80-85
Cambridge Aerosolve 85	99	80-85	50-60
Cambridge Aerosolve 35	96	30-35	20-30
Electric Precipitator	99	85-90	60-70
2" Cleanable	76	8-12	2-5
2" Throwaway	76	8-12	2-5

*Practically 100%. Test not practical for more accurate reading.

#National Bureau of Standards Discoloration Test.

**Maximum Allowable Penetration of Dioctyl Phthalate Smoke 0.05%. Every filter individually tested.



Cambridge AEROSOLVE Filter

Cambridge filters, used alone or with pre-filters to take out the "chickens," give you high-efficiency air cleaning at only a fraction of previous costs. Wide range of efficiencies, from the Cambridge AEROSOLVE 35 to the world-famous Cambridge ABSOLUTE.

Cambridge AEROSOLVE Filters have a rugged permanent frame for long life. Light, compact cartridges, in a wide range of efficiencies, provide long service life and are easily replaced. No maintenance required.

Take advantage of Cambridge's unequalled experience in the field of high-efficiency air filtering. Ask the Cambridge man to help you lick your tough filtering problems.

Write for
AEROSOLVE Filter Bulletin 105A
ABSOLUTE Filter Bulletin 106A

CAMBRIDGE FILTER CORP.

Pioneers in High-Efficiency Air Cleaning

734 E. Erie Blvd. Syracuse 3, N. Y.

Representatives in Principal Cities

WHY

HERE'S YOUR *Complete* STEAM PLANT

- One purchase, backed by undivided responsibility.
- Shipped completely assembled after factory tests to assure highest operating efficiency.
- More than 80% thermal efficiency guaranteed.
- 4-pass design provides 5 sq. ft. of heating surface per b.h.p.
- Induced draft fans which are built-in eliminate the need of an expensive chimney.
- Simple installation requires no special foundation.
- Clean, quiet operation.
- Heavy-duty, rugged construction assures long-lived dependability.
- Burner equipment to suit your fuel: gas, oil or both.
- 18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i., or for hot water heating.

For complete details, write for catalog 804-F.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR
STEAM GENERATORS

WHO'S WHAT

Continued

▸ *SCHEMENAUER MFG. CORP.*—New sales representatives and the territories they will cover are: Altherm, Inc., metropolitan New York; Associated Sales Engineering, Oklahoma; Heath-Crowley, central Pennsylvania; R. R. Waites, Missouri; Tower Boiler Sales, California; Leffler Engineering Sales, Montana, Wyoming; Gene Hewitt, North Carolina, Virginia.

▸ *L. O. F GLASS FIBERS CO.*—Distribution outlets for "Duramesh" reinforcing fabric are: Wimsatt Bros., Inc., Louisville; Central States Steel, Council Bluff, Iowa; May Material Co., Kansas City.

▸ *MERCOID CORP.*—W. K. Stauffer, vice president in charge of eastern area; R. F. Fisher, vice president to supervise sales activities for west coast area; John Shedden and F. W. Ayer, managers of New York and Philadelphia branches, respectively.

▸ *TORK CLOCK CO., INC.*—Fred D. Benz Co., sales representative in northern California.

▸ *TRANE CO.*—Gary Mays, representative in charge of new sales suboffice in Albuquerque; Donald E. Jackle, assigned to Philadelphia sales office.

▸ *AUTOMATIC SWITCH CO.*—Delaware Valley Engineering Co., distributor for solenoid valves for Delaware, southern New Jersey, eastern Pennsylvania.

▸ *INLAND STEEL PRODUCTS CO.*—M. Ray Greene, manager of new regional area which includes company's Buffalo, Cincinnati, Cleveland branches.

▸ *DRAYER-HANSON, INC.*—Harvey Lange, sales application engineer.

▸ *WORTHINGTON CORP.*—Petroleum Heat and Power Co., Inc., wholesale distributor for Long Island, N. Y., and Westchester and Fairfield Counties, Conn.

▸ *AIR-MAZE CORP.*—A. F. Siers, factory representative to handle special accounts in Ohio, Michigan.

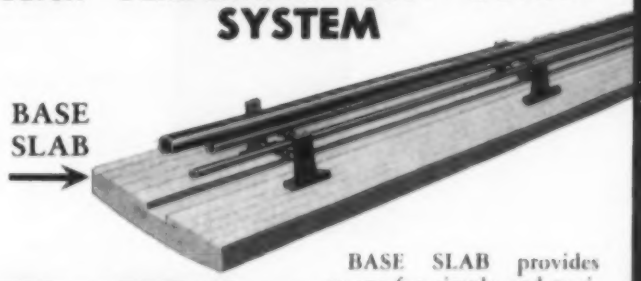
▸ *BALTIMORE AIRCOIL CO., INC.*—Si Williams, representative for northern Ohio, western Pennsylvania.

▸ *WARNER ELECTRIC BRAKE & CLUTCH CO.*—Clifford Petterson and John Erbach, sales engineers for Los Angeles and eastern Wisconsin areas, respectively.

WHY Therm-O-Tile

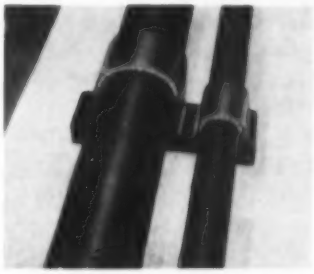
REG. U.S. PAT. OFF.

FOR YOUR UNDERGROUND HIGH TEMPERATURE HOT WATER SYSTEM



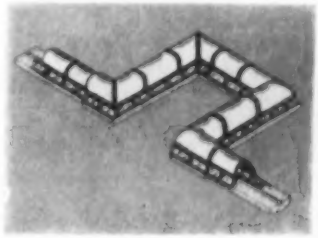
BASE SLAB provides means for simple and positive anchoring and guiding of High Temperature pipe lines as shown at the left and below.

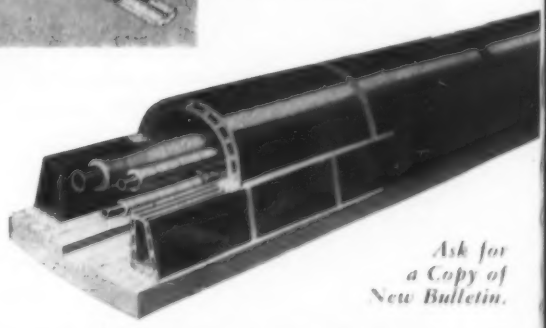
Piping is easily installed on supports with all joints exposed for welding and inspection.



Expansion of piping is easily accommodated within the conduit. See figure below, which also shows why Therm-O-Tile Conduit is easily adaptable to changes in field conditions.

Just a few points — but all contributing to an economical installation and means for insuring permanent efficiency of your distribution system.





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REID HAYDEN, INC.

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The engineering service departments of Webster and its exclusive agents would welcome the opportunity to help solve your combustion problems, to make recommendations and quotations.

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The
WEBSTER ENGINEERING *Company*
TULSA 1, OKLAHOMA

Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

WHO'S WHAT *Continued*

▸ *ILLINOIS ENGINEERING CO.*—Hugh H. Mallaney, sales engineer for Chicago area.

▸ *MARLO COIL CO.*—Ward & Black Engineering Sales, representative in Pittsburgh area.

▸ *MARSH INSTRUMENT CO.*—Thomas Zurick, sales representative for Indiana.

▸ *AMANA REFRIGERATION, INC.*—Lloyd L. Goodwin, service representative to assist dealers and distributors in southern states.

▸ *A. M. BYERS CO.*—Paul A. Benoit and Albert L. Timm, field service engineers assigned to New York division office.

▸ *RUUD MFG. CO.*—K. M. Thompson, manager of metropolitan New York branch sales office.

▸ *STRUTHERS WELLS CORP.*—John W. Pike, eastern district manager.

▸ *CRANE CO.*—Harold H. Stift, Chicago branch manager; Donald R. MacCrimmon, assistant manager of Chicago branch; Frank R. Perry, manager of Los Angeles branch; Leo F. Regan, assistant branch manager at Springfield, Mass.; Robert E. Muse, assistant manager of Los Angeles branch; John F. Heaslett, San Diego branch manager; Scott B. Wescott, assistant to West Coast district manager; Robert W. Bomesberger, manager of Detroit branch; James A. Beekman, Rockford, Ill., branch manager.

▸ *POWERS REGULATOR CO.*—Evan D. Graham, manager of new Portland, Ore., branch.

▸ *WESTINGHOUSE ELECTRIC CORP.*—J. L. Perry Co. and Air Rite Products Co., distributors for Nashville, Tenn., and Macon, Ga., respectively, for company's packaged air conditioning line, including heat pumps. Layton Supply Corp., Westinghouse's Wisconsin-upper Michigan distributor, has named John J. Cullinane as president.

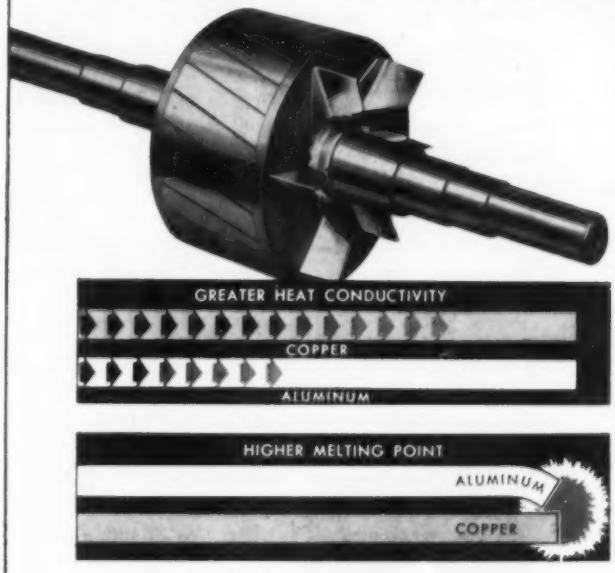
▸ *CONOFLOW CORP.*—Chemical & Industrial Sales, Ltd., sales-engineering representative for Alberta and Saskatchewan, Canada.

▸ *THATCHER FURNACE CO.*—Henry J. Linskey, sales engineer for Philadelphia-Wilmington area.

HEAT DISSIPATING COPPER-CLAD ROTORS

PLUS values in power

in HOWELL series one hundred motors give you



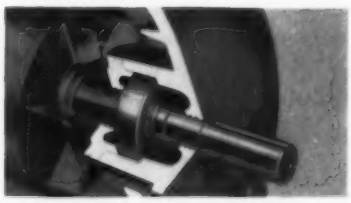
COOL-RUNNING EFFICIENCY, GREATER ABILITY TO WITHSTAND ABUSE

The copper bar rotors of Howell Series 100 motors mark a basic difference between these and motors with cast aluminum rotors. Copper's greater heat conductivity insures that internal motor heat is dissipated faster . . . before it can deteriorate vital insulation and shorten motor life. The diagram at left shows why . . . copper's heat conductivity is 91% greater than aluminum's.

What's more, copper's higher melting point . . . 1083° F. against 660° F. for aluminum . . . plus the inherent uniformity and greater strength of Howell's copper-clad rotors, means substantially more stability under overload conditions.

There's a world of difference in motors. Compare . . . and you'll specify Howell Series 100.

GET THE PLUS values THAT COUNT....specify HOWELL series 100 motors



Howellube greasing system checks over-lubricating

Grease enters and exits on same side of bearings — is never forced through to pack them tight. Results: longer bearing and motor life.

steel feet and frames won't crack under stress

Unlike cast iron, steel feet won't crack when mounting bolts are tightened too much . . . and Howell's steel frames take more installation punishment.

smaller, lighter, better looking

Save machine and storage space, save shipping weight, and get new functional streamlining that matches the motor to your most modern machine design or production equipment. Why put up with dust catching fins on a motor, when sleek good appearance costs no more.

For more details on Series 100 motors, write for Bulletin N-100-R

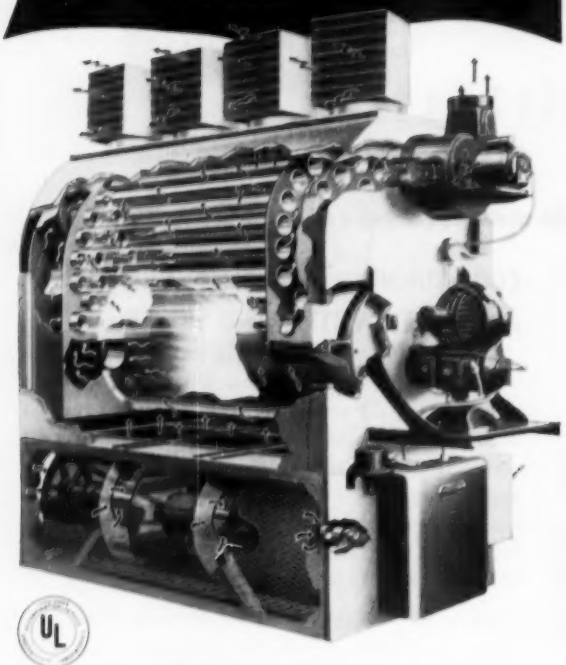
PRECISION-BUILT MOTORS FOR INDUSTRY SINCE 1915

HOWELL Red Band MOTORS

HOWELL MOTORS

HOWELL ELECTRIC MOTORS COMPANY, HOWELL, MICHIGAN

Commercial-Aire



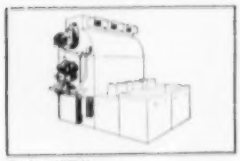
DIRECT-FIRED

Space Heaters

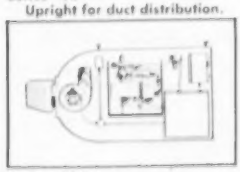
300,000 BTU's

TO 2,000,000 BTU's

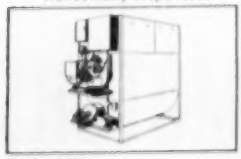
Provides industry with lowest cost heating. Primary cylindrical stainless steel combustion chamber, secondary heat-extracting tubes, consistent rate of combustion gas flow provide high efficiency, utilizing 80% of available heat of fuel. Highly adaptable to desired mounting arrangements. Features low first cost, easy maintenance, complete accessibility to all service points. Completely equipped and wired with controls for economical installation.



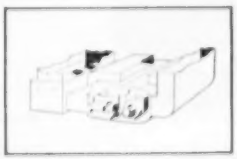
Series "FD"
Upright for duct distribution.



Series "H"
Horizontally suspended.



Series "U"
Inverted suspended.



Series "HD"
Horizontally for duct distribution.

MAMMOTH FURNACE CO.
6425 Cambridge St.
Minneapolis, Minn.

Send full details, prices, delivery dates, etc., on Commercial-Aire Heaters.

NAME_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

WHO'S WHAT

Continued

▸ *AMERICAN AIR FILTER CO., INC.*—Morris G. Munson, southern regional manager responsible for field sales organization in Florida, Georgia, Alabama, Mississippi, Louisiana, Texas, Arkansas, Oklahoma; J. M. Osborne, southern regional supervisor of unit ventilator and heating and ventilating products. He will be under the supervision of Mr. Munson.

▸ *CYCLOTHERM DIV., NATIONAL-U.S. RADIATOR CORP.*—Boiler Engineering Div. of Garratt Engineering and Equipment Co., northern California distributor.

▸ *LANCASTER PUMP AND MFG. CO.*—Howard Alsop, direct factory salesman to serve distributors in Georgia, the Carolinas.

▸ *ALL-STATE WELDING ALLOYS CO., INC.*—Robert Nordin, regional manager to cover Louisiana, Mississippi, east Texas, southern Alabama, Florida panhandle.

▸ *SURFACE COMBUSTION CORP.*—Promotions within F. J. Evans Engineering Co., Surface Combustion's southern representative, are: J. K. Hawk, director and vice president in charge of engineering; N. B. Buehrer, executive vice president; D. M. Mills, vice president in charge of Houston division; Jack J. Tyson, vice president in charge of Atlanta division.

▸ *SPANG-CHALFANT DIV., NATIONAL SUPPLY CO.*—Donald E. Draper, Detroit sales representative. He succeeds Harold R. Goodwin, retired.

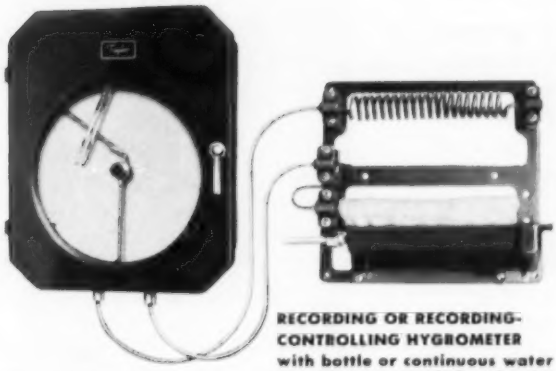
▸ *ARMSTRONG CORK CO.*—Sales engineers assigned to district offices of company's insulation division are: Harland R. Caswell and Frederick F. Hauser, Chicago; Bobby R. Caudle, Kansas City, Mo.; Bernard J. DeWolf, Detroit; Robert W. Hattemer, Pittsburgh; Donald W. Kuhn, St. Louis; John T. O'Hara, Philadelphia.

▸ *UNITED STATES AIR CONDITIONING CORP.*—Absorption Cooling & Heating, Chicago distributor; Mazzotti & Russo, New York dealer.

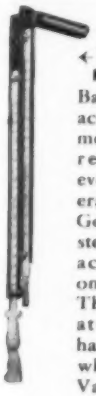
▸ *BABCOCK & WILCOX CO.*—J. N. Rogers, sales representative in charge of St. Louis office for company's tubular products division. He replaces Frank T. Murphy, retired.

▸ *PEERLESS ELECTRIC CO.*—Paller Engineering Co., Indianapolis factory representative for company's fan and blower division.

TAYLOR AIDS *to Air Conditioning*

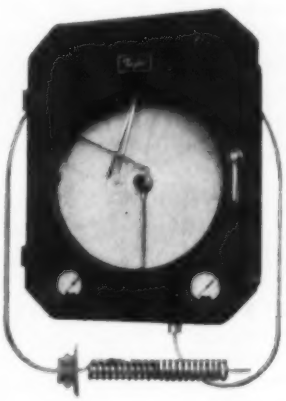


RECORDING OR RECORDING-CONTROLLING HYGROMETER with bottle or continuous water feed. Recommended under the following conditions: Good air circulation; panel advantageously located within apparatus room or duct for best circulation across the bulbs. Available with bottle-feed or continuous water supply.



NEW TAYLOR SLING PSYCHROMETER

Basic standard for accurate measurement of humidity—redesigned for even simpler operation. New 9" Gold Back etched-stem thermometers accurate within one scale division. The new rigidly-attached swivel handle folds back when not used. Variety of F. and C. ranges available.



TAYLOR FULSCOPE* TEMPERATURE CONTROLLER. Keeps lever motors, diaphragm valves, dampers, etc., in proper sequence to make your air conditioning system work perfectly. Automatically compensates for load changes. Controls refrigeration compressors. Gives you automatic seasonal changeover.

• • •

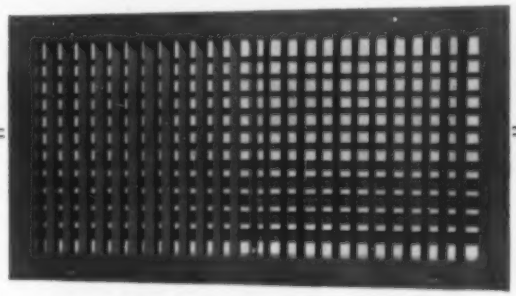
Ask your Taylor Field Engineer about these instruments, or write for **Catalog 5.** Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

*Reg. U.S. Pat. Off.

Taylor Instruments
MEAN ACCURACY FIRST

Now You Can Have Absolute Air Control

UP . . . DOWN
LEFT . . . RIGHT
. . . *ANY VOLUME!*



A-J

AIR CONDITIONING GRILLE

With Detachable Volume Control

Here's the perfect grille for air conditioning! Specially designed, extruded aluminum louvers reduce air friction to minimum. Available in four styles — vertical, horizontal or a combination with either deflection for face bank of bars.

Tamper-proof Adjustment

Louver bars are mounted in frame and mullion by patented process. Positive setting with hand tool. Can not be moved by tampering or air pressure after system is balanced. Mechanism is completely enclosed by double frame. Available with — or without metering damper described below.

Controls Air from a Whisper . . . to a Blast!

A-J OPPOSED BLADE DAMPER

This detachable damper allows engineer to balance the system to most exacting demands. Blades operate in opposite directions simultaneously from fully opened (90°) to closed (32°). Distributes air *evenly* over entire face of grille.

Positive Gear Drive Mechanism

Drive operator consists of gear, gear track and non-metallic clutch. Works easily, locks in any position. Adjusts with Phillips screw driver.

FREE CATALOG
Lists over 1000 types and sizes of grilles and registers. Write for it!

A-J MANUFACTURING CO
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3601 East 18th St.
Kansas City, Mo.

FURNAS ELECTRIC CONTROLS

do the best job for AIR CONDITIONING and REFRIGERATION

SAVE WITH "In-Between" SIZES

Instead of just 5 Magnetic Starters in the 1 to 100 hp range, Furnas Electric offers you 9 sizes—the 5 standard sizes plus 4 "in-between" sizes. The many "in-between" sizes in the Furnas Electric line allow you to choose the control that is best suited for your particular job—at a saving to you in cost, space and capacity.

WRITE TODAY FOR BULLETIN 5411—1041 McKEE STREET, BATAVIA, ILLINOIS

A10

FURNAS ELECTRIC COMPANY

BATAVIA, ILLINOIS

Sales Representatives in all Principal Cities

WHO'S WHAT

Continued

▸ *BALTIMORE AIRCOIL CO.*—J. P. Ashcraft Co., Inc., sales representative in northern Texas, Louisiana; Taylor, Lipscomb & Appel, Inc., a similar appointment for Texas.

▸ *CARRIER CORP.*—Gilbert T. Stacy and Harold C. Cook, Charlotte district manager and Atlanta district "Weathermaker" air conditioning specialist, respectively, for company's Unitary Equipment Div.

▸ *CELANESE CORP. OF AMERICA*—Arthur E. Berngen, in charge of 12 state sales area with headquarters in Chicago, to handle industrial textile products.

▸ *WOLVERINE TUBE, DIV. OF CALUMET & HECLA, INC.*—Van D. Clothier, Inc., to operate Wolverine's new mill depot in San Francisco; B. J. Wuerthner, appointed to sales staff of company's midwest district.

▸ *INLAND STEEL PRODUCTS CO.*—Harold E. Rossiter, manager of new district sales office at Atlanta; Raymond W. Puterbaugh, general sales representative in Minnesota, the Dakotas.

▸ *RUUD MFG. CO.*—Bailey Lumber Co., distributor for commercial gas water heaters in southern West Virginia.

▸ *JAS. P. MARSH CORP.*—Harry Kirby, district manager for Ohio, Pennsylvania, most of New York.

▸ *J. F. PRITCHARD & CO. OF CALIFORNIA*—Sears-Westall Co., representative for eastern Missouri, southern Illinois, southern Indiana, western Kentucky.

▸ *ROBERTSHAW-FULTON CONTROLS CO.*—David R. Prince, district sales manager of Dayton-Cincinnati territory for company's Fulton Sylphon Div.

▸ *AUTOMATIC SWITCH CO.*—Stocking distributors of solenoid valves are: Hydraulic Equipment Co., Los Angeles; Hendrie and Bolthoff Co., Denver. John J. Herrity, Asco's engineering consultant, has added Sidney Dubinsky to his staff and opened a Baltimore office. Mr. Dubinsky will serve that area.

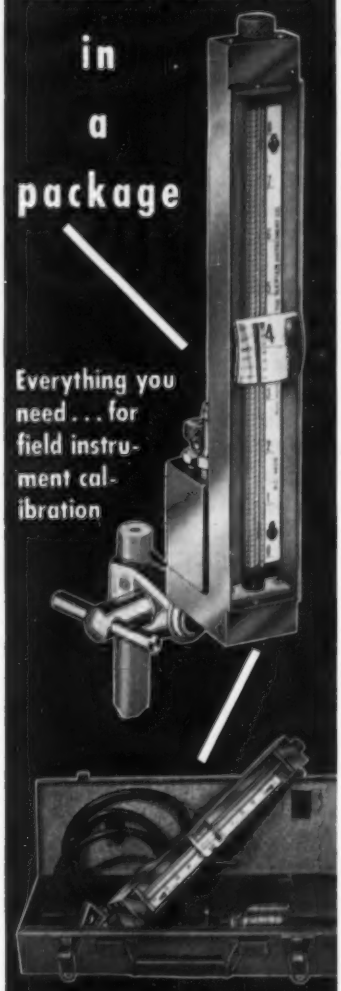
▸ *DELAVAN MFG. CO.*—Fred Mulcahy, sales engineer.

▸ *AMANA REFRIGERATION, INC.*—Parker Co., wholesaler for room and central air conditioners in Colorado, parts of Wyoming, western Nebraska; Worthen's, distributor for Clark County, Nev. ≠

UNMATCHED ACCURACY

in a package

Everything you need . . . for field instrument calibration



MERIAM Manometer Kits

- Magnifying sight glass
- Mirror for resolving parallax
- Built-in level indicator
- Precision-bore pyrex tubing
- Built-in fluid seal
- All stainless steel construction

Write for Bulletin B-2862.

Meriam Manometer Instrumentation ...for pressures, vacuums, flows, liquid levels.

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GOODALL EXPANSION JOINTS

Because they are made of rubber, Goodall Expansion Joints have certain advantages stemming from rubber's natural characteristics. Among these are the following:

1—LONGER SERVICE LIFE. Continuous movement during expansion and contraction actually keeps the rubber joint "alive". There is no deterioration through embrittlement or corrosion.

2—SENSITIVE RESPONSE TO PRESSURE. Only the slightest pressure is required to create movement in the rubber joint, in any direction. Stress on metal pipe or other connected member is therefore reduced to an absolute minimum.

3—EASIER TO INSTALL . . . on new construction or as replacements for other types. Light in weight . . . short face-to-face dimensions . . . retaining rings or flanges quickly aligned and bolted. No gaskets required.

4—AVAILABLE IN "FLANG-LOK" STYLE . . . a patented Goodall development which provides exceptional ease of installation; a far greater sealing face area than the standard right-angle style; and a seal that is completely non-metallic.

* * *

Goodall Rubber Expansion Joints are custom-built to meet specific requirements in sizes from ⅜" I. D. to 96" I. D., for pressures up to 125 lbs. P.S.I. and/or vacuum. They are available in Right Angle and Sleeve Types, as well as "Flang-Lok"; single or multiple arch; tapered; offset; and rectangular.

* * *

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Standard of Quality—Since 1870

HOSE • BELTING • FOOTWEAR • CLOTHING AND OTHER INDUSTRIAL RUBBER PRODUCTS

GOODALL *Rubber Company*

GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.

Branches and Distributors Throughout the United States and in Canada

FLEXIFLO

The Diffuser for Every Application

Here's the complete diffuser line with all extra features: built-in equalizing deflectors; easy to install; quick adjustment of air volume and diffusion pattern; simplified engineering; beautifully finished in any color baked enamel.

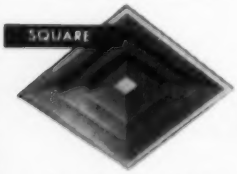
Let our sales engineers show you why Flexiflo is better for your jobs. But first — get the Flexiflo catalog.

Type R, constant flow pattern regardless of volume adjustment.

Type V, fully adjustable air diffusion pattern and volume.

Type MP, for 1-, 2-, 3- or 4-way diffusion to accommodate any shaped area, 16 styles.

Type CH, adjustable for heating, ventilating and cooling.



Type H, adjustable volume, constant pattern and radius of diffusion.

Type S, side wall or ceiling, with Type R or V blades for heating or cooling.

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FLEXIFLO **UNIVERSAL DIFFUSER CORP.**
38 Marbledale Road, Tuckahoe, N. Y.

Please send me complete catalog HP

NAME_____

COMPANY_____

STREET_____

CITY_____ ZONE____ STATE_____

WE HEAR THAT . . .

▸ *JOHN KILMER*, chief engineer, *GOLDEN-ANDERSON VALVE SPECIALTY CO.*, has designed special valves for use in the new 1500 mile guided missile installation at Patrick Air Force Base, Florida. This design was for a special surge relief valve with auxiliary electrically controlled pilots to protect an extensive water distribution system used in cooling and launching pad. The capacity of this system is said to equal or exceed the water requirements of a small city.

▸ Ground breaking ceremonies were held recently at the plant site of *AMERICAN BRASS CO.'s* integrated aluminum mill at Terre Haute, Ind. The mill, together with separate buildings to house an office and research laboratory, will cover a space in excess of 500,000 sq ft. Construction cost will amount to more than $25 million, according to the company.

▸ *LINCOLN ELECTRIC CO.* plans an $8 million expansion to its plant capacity for manufacturing arc welding machines and electrodes. Work is underway to complete $2 million of this expansion by the end of the year. The project is planned for completion within the next three years. The program will provide 60 percent more manufacturing capacity in the company's Cleveland plant.

▸ Forced to relocate its St. Louis office due to highway construction, *CHASE BRASS & COPPER CO.* has erected new and larger quarters at 4641 McRee Ave., in that city. The structure has 40,000 sq ft of warehouse space.

▸ Heating equipment manufactured by *TRANE CO.* was exhibited recently to the employees of the Baltimore division of *REVERE COPPER AND BRASS, INC.* The exhibit was placed in the customer display booth at the Baltimore plant.

▸ *WEBSTER ENGINEERING CO.* will build a new plant and general office at Tulsa. To be located on a four acre tract, the facility will cost around $275,000, exclusive of equipment and other contents. In addition to the main plant and office structure there will be a laboratory in a second building.

▸ University of Michigan, Georgia Institute of Technology and Texas A & M College have been added to the scholarship list of *TRANE CO.* Faculties at the colleges are selecting engineering students for the scholarships beginning with the fall term this year. Payments by the company will go to one senior student at Georgia Tech, one senior at Michigan and one senior and one junior at Texas A & M.

New design Refrigerant Condenser

...gives far more efficiency and better, trouble-free service

With this new, sectional design Niagara condenser you avoid the many troubles due to faulty condensing and get at all times the full capacity your refrigerating plant should afford.

You benefit from extra saving in upkeep labor and expense. The casing of this new condenser is made of sections each separately removable, giving you access to all parts for easy inspection to head off dirt and corrosion, to clean the coils easily from either side.

You benefit from greater efficiency in condensing. A simpler method of using evaporative cooling improves heat transfer. You benefit from Niagara features that remove super-heat before condensing and keep the system purged of oil. You save 95% of the cooling water cost.

You benefit from a low first cost, lower freight cost and less expense in erection.

Capacity range is from 90 to 240 tons. Write for Niagara Bulletin 131. Find out how your plant can save expense this season.

NIAGARA BLOWER COMPANY

Dept. HP, 405 Lexington Avenue
NEW YORK 17, N. Y.

District Engineers in Principal Cities

NIAGARA — *Over 40 Years' Service in Industrial Air Engineering*

"WITCH"

PIPE HANGERS

FOR

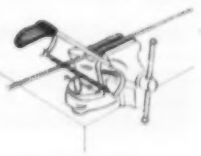
HEATING – PLUMBING POWER & PROCESS

STOP WASTING MAN HOURS

USE PRE-THREADED HANGER ROD

FIG. 94 ALL THREAD ROD

SINGLE SAW CUT FABRICATES ANY HANGER ROD
¼" THRU ⅞" DIA.
UP TO 72" LONG



Our catalogue illustrates a complete line of Pipe Hangers & Supports and is an indispensable reference book for engineers, contractors, estimators & erectors. Write for your copy now.

MAINTAINING OFFICES AND WAREHOUSES ACROSS THE NATION

CARPENTER and PATERSON, Inc.

18 HURLEY ST., CAMBRIDGE, MASS.

WE HEAR THAT

Continued

▸ The completely air conditioned office building housing headquarters personnel of *CARRIER CORP.'s* Dallas district opened recently. The single-story structure, which includes areas for light assembly work and storage, provides expanded space for district operations for the company's Machinery and Systems and Unitary Equipment Divs.

▸ Three more building projects have been approved by *TRANE CO.* directors, it has been announced. The new projects include a 5040 sq ft addition to the research and testing laboratory, a new 45,000 sq ft warehouse building and a 4800 sq ft paint storage building.

▸ *TITEFLEX, INC.* has completed the move consolidating its facilities at Springfield, Mass. The consolidation, costing $1,500,000, was accomplished to take full advantage of the economies and efficiency derived from the operation of one plant. The plant now comprises over 300,000 sq ft, having been enlarged by 40,000 sq ft.

▸ *ROCKWELL MFG. CO.* plans to occupy a new 180,000 sq ft valve manufacturing plant at Kearney, Neb. Company officials estimate the new plant, expected to be completed by midsummer of 1957, will cost approximately $2 million. The facility will be used for machining, assembly and testing of Rockwell-Nordstrom "Hypreseal" valves, which are primarily used by the oil, natural gas, chemical and chemical processing industries.

▸ A one-story manufacturing and shipping addition to the *JOHN J. NESBITT, INC.*, plant has been completed. The structure covers 40,000 sq ft.

▸ The *WOLVERINE TUBE, DIV. OF CALUMET & HECLA, INC.* Diamond Key Award was presented this year to *D. J. MISSIMER* of Pacific Refrigeration Co. for his article, *Cascade Refrigeration Systems for Ultra-Low Temperatures.* The award presentation was made at the annual meeting of the American Society of Refrigerating Engineers.

▸ *RODGERS ENGINEERING CO.*, north Texas distributor for *MUELLER CLIMATROL* and *KENNARD CORP.* air conditioning equipment and accessories, has announced the construction of a new office and warehouse at Dallas.

▸ A new mill depot has been opened in Rock Island, Ill., designed to serve customers of *WOLVERINE TUBE, DIV. OF CALUMET & HECLA, INC.* in the western Illinois and eastern Iowa area.

In All This World

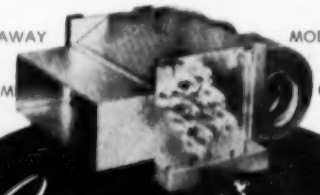
no finer air-conditioning than International as installed in

THE PARK PLAZA HOTEL, ST. LOUIS

Yes, after personal inspection of similar installations, the Park Plaza chose International with utmost confidence. For only International gives you such powerful, yet whisper-quiet operation, based on proved basic engineering which eliminates ductwork . . . cuts installation costs to a minimum. Each unit individually controlled for complete summer and winter comfort. Write, wire or call for full information now.

CEILING HIDEAWAY — MODEL C. H. W. 90

ALL ALUMINUM — CONSTRUCTION



International

the most practical air conditioning ever built!

MANUFACTURING COMPANY

Air Conditioning Division

600 E. GRAND AVENUE — OKLAHOMA CITY, OKLAHOMA

CABLE ADDRESS "INTIME"

Cut customer fuel bills 7 days a week

it's good business to always install a PARAGON 700 Series Calendar Time Switch on commercial heating units

YES, the good word gets around fast when a Paragon 700 Series Time Switch is on the job cutting heating bills. Heat is *automatically turned off* when not needed. Customer satisfaction through lower fuel bills *plus* fewer service "call backs" are big profit boosters for you! Check these features: :

- **COMPLETELY FLEXIBLE** — completely economical. Switch settings can be made for the entire week's schedule, yet easily and quickly changed. ON-OFF or OFF-ON operation can be as close as 3 hours.
- **FULLY AUTOMATIC** — set it, then forget it. Saves money weekends, for example: switch may be set to cut off heat Saturday noon, then automatically start regular heating cycle earlier than usual Monday.
- **INSTANTLY CHANGEABLE** — simply set the dial trippers at desired day or night hours. Total of 14 are supplied as standard equipment.

Dial is graduated in hours and half-hours. Night and day periods clearly separated. Available in 24, 120 and 240 volts; 25, 50 and 60 cycles. No complicated wiring. Lists as low as $28.50.

Ask for Bulletin HP-5407

See your jobber, or write: Dept. 1811

PARAGON ELECTRIC COMPANY

TWO RIVERS, WISCONSIN

World's Foremost Manufacturer of Time Controls

LORD BALTIMORE

puts Goulds pumps into its air conditioning system

With your specialized knowledge of air conditioning problems, you can recognize the convenience and efficiency of the Lord Baltimore's new air conditioning system.

The system permits *each* guest in one 14-story wing of the hotel to select "just right" temperatures all year 'round. There is a separate air supply system for ventilation and humidity control of each room, with separate fan units in the corridors. The entire system *depends on no pumps other than Goulds.*

Three Goulds Fig. 3405 pumps circulate chilled or warm water at 220 gallons per minute each through the fan window units. Three Fig. 3405 pumps, each rated at 700 gallons per minute, are used on cooling tower service. Three Fig. 3460 pumps, each of 125 gallons-per-minute capacity, circulate water through refrigerating machines and units which supply ventilating air.

Fig. 3405 pumps handle cooling tower service and provide chilled or warm water for room units.

These three Fig. 3460 pumps handle cold water to cool incoming air for ventilating system.

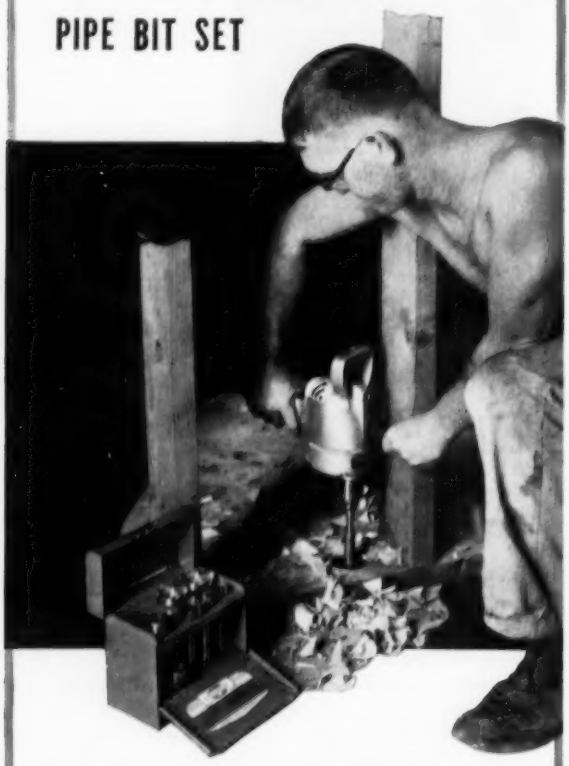
The Lord Baltimore gets dependable pumping with Goulds pumps. If *you* are planning a new installation—or modernizing an old one—contact your Goulds representative. That way you can get a circulating system that's as efficient and dependable as the one in this modern Baltimore hotel.

MEMBER HYDRAULIC INSTITUTE

Goulds PUMPS INC. Seneca Falls New York

Sales Offices: Atlanta • Boston • Chicago • Houston • New York • Philadelphia • Pittsburgh • Tulsa

QUICKLY BORE PIPE-SIZE HOLES IN WOOD WITH GREENLEE PIPE BIT SET



Make swift, easy work of an otherwise tedious, hard job. Quickly cut clean "tailor-made" openings for ½" to 2" pipe with the GREENLEE No. 1440 Pipe Bit Set. It is designed especially for plumbers, steamfitters, and electricians to provide fast, easy boring of *smooth* holes in wood — studding, floors, joists, etc. Bits are precision made and of highest quality for long life and clean, speedy boring. Made with ½" shanks with 3 flats for use in portable electric or pneumatic drills and in stationary boring machines. An adapter is provided in the set for using the bits with standard auger-bit braces. Set also includes electric drill adapter and coupling for using standard ¾" pipe as an extension for deeper boring and longer reach. Set contains six bits for boring holes to accommodate the following pipe sizes: ½", ¾", 1", 1¼", 1½", 2". Bits, adapters, and coupling packed in an attractive, sturdy metal box with convenient carrying handle. Write today for descriptive folder.

TOOLS FOR CRAFTSMEN
GREENLEE

Greenlee timesaving tools for plumbing and heating work: Hydraulic Pipe Pushers • Hydraulic Pipe Benders • Tubing Benders • Pipe Bits Auger Bits • Spiral Screw Drivers • Chisels • And many more Greenlee Tool Co., 2349 Twelfth Street, Rockford, Illinois.

WE HEAR THAT

Continued

▸ *AIR REDUCTION PACIFIC CO.* will build a new air liquefaction plant in the Los Angeles area. The facility is designed to produce daily 55 tons of high purity liquid oxygen, 15 tons of liquid nitrogen, and 3½ tons of liquid argon. The cost of the plant will be in excess of $7,500,000, the company reports. Completion is scheduled for the second half of 1957.

▸ The Pittsburgh branch sales office of the heating and air conditioning division of *NATIONAL-U.S. RADIATOR CORP.* has moved from 125 First Ave. to 2666 W. Liberty Ave. in that city.

▸ *FULLER CO.* has acquired all of the assets of *LEHIGH FAN & BLOWER CO.* This transfer included trademarks, tradenames and the goodwill of the business, which will be continued without interruption as *LEHIGH FAN & BLOWER DIV., FULLER CO.*

▸ *REVERE COPPER AND BRASS, INC.* has adopted a system of identifying its types of copper tube with a variety of colored inks. Such a system is designed to provide rapid and certain identification of the type of tube desired. The identifying colors are the standard selections of the Copper and Brass Research Association.

▸ The name of the Ryertex-Glyco Div. of *JOSEPH T. RYERSON & SON, INC.* has been changed to the Industrial Plastics and Bearings Div. The new name is designed to give a clearer picture of the broadening operations of the division.

▸ *TUBE TURNS* has bought 13 acres of industrial property in Louisville for expansion purposes. The price was $2 million.

▸ *AMCO PLASTIC PIPE CO.* has started construction of a plant in San Leandro, Calif. The building will have 45,000 sq ft of floor space. This will double the company's present capacity.

▸ *AIR REDUCTION SALES CO.* has produced a 20 min, sound slide film entitled "Always on the Job" covering the basic principles of safety in electric arc welding. The company announces its availability on free-loan or purchase bases.

▸ *A. M. BYERS CO.'s* Pittsburgh south side plant has been awarded a certificate of merit for safety by the Pennsylvania Manufacturers' Association in recognition of 299,552 man hours worked without lost time injury.

??? WHY... ???

Combi-Matic

Forced Draft **GAS OIL** **Burners**

Here are THREE IMPORTANT REASONS...

(and there are more)

Underwriters' Laboratories listed

FGO Series... GAS-OIL BURNER—6 models in capacity to 3,500,000 BTU input.

1. POWER combi-matic offers the most complete line and advanced design for light oils and gases.
2. Now! controlled combustion on both gas and oil... with higher efficiency and lower operating costs.
3. Positive and complete safety with a pre-purge period in standard operating cycle.

MORE SALES FOR YOU... BECAUSE THERE ARE MORE ADVANTAGES FOR YOUR CUSTOMERS:

- Factory "FIRE-TESTING" insures... "on the job" performance.
- Automatic air adjustment... lets you set it—forget it.
- Electronic safeguard... responds immediately to flame interruption.
- Pressure safety control... prevents opening of either fuel valve unless air for combustion is proven.
- Optional automatic or manual changeover...
- GAS ELECTRIC IGNITION... is automatic on BOTH fuels.

SOMETHING EVERY DEALER WANTS:

- Less installation time.
- Standard parts and controls always and immediately accessible...

Power combi-matic Gas-Oil burners are but one important part of a complete line of burners.

FG Series—Power gun type burners—ideal for all conversion applications... particularly oil burner replacement.

BFG Series—Heavy duty Power-Flame burners—large capacities for heating, power or processing.

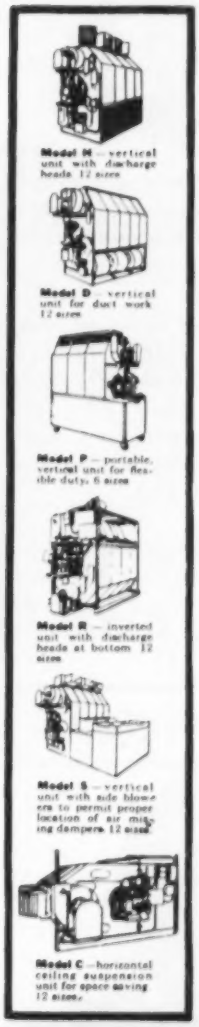
A Power-Flame Dealership can be valuable; write today for complete information

Power-Flame **BURNER**

A Division of

Siemon Manufacturing Company • Grandview, Mo.

SEND TODAY FOR LATEST HEATER DATA



Model M — vertical unit with discharge heads 12 sizes

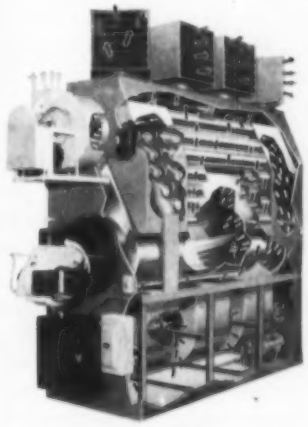
Model D — vertical unit for duct work 12 sizes

Model P — portable, vertical unit for flexible duty, 6 sizes

Model R — inverted unit with discharge heads at bottom 12 sizes

Model S — vertical unit with side blowers to permit proper location of air mixing dampers 12 sizes

Model C — horizontal ceiling suspension unit for space saving 12 sizes



Tempering Make-up Air? Drying? Space Heating?

Let National Heater Company show you how space heating and ventilating problems can be solved **efficiently** and **economically.** No matter how large or small a plant may be, National Champion Heaters **save** money on installation, operation and maintenance.

NATIONAL Champion

DIRECT FIRED HEATERS

6 Models 66 Sizes
400,000 to 2,000,000 BTU's
Automatic Operation
PLUS Year-Round VENTILATING!

Direct-fired for gas, oil and combination fuels. Approved by American Gas Association. Listed by UL

WRITE TODAY FOR A NEW 6-PAGE BROCHURE LISTING SPECIFICATIONS AND DIMENSIONAL DATA OF 1956-57 LINE OF NATIONAL CHAMPION HEATERS.

NO OBLIGATION! MAIL THIS COUPON TODAY!

NATIONAL HEATER CO., Inc., 2180 Cleora Avenue, St. Paul 4, Minnesota

Gentlemen:

We're interested in knowing more about National Heaters as noted below:

☐ Send additional material on the 1956 line.

☐ Have your representative call on us.

FIRM NAME:_____

ADDRESS:_____

BY:_____

POSITION:_____

NATIONAL HEATER CO., INC.

2180 Cleora Ave. St. Paul 4, Minn.

WE HEAR THAT

Continued

▸ Sales personnel from the special military products and commercial portable heater departments of *AMERICAN AIR FILTER CO., INC.*, have been moved from Moline, Ill., to Louisville. The move was made to bring the sales of those departments into closer coordination with the company's other sales departments.

▸ *FEDDERS-QUIGAN CORP.* will fly some 5000 salesmen and their wives to the Caribbean this fall for expense-paid vacations won in a sales contest. Scheduled to begin September 24, this number doubles the 2500 flown to Jamaica last year.

▸ Plans for a general expansion of operating facilities have been announced by *FLEXIBLE TUBING CORP.* First step will be the addition of 5000 sq ft of warehouse space to the Guilford, Conn., plant. The company also plans to expand its western operations in Los Angeles to include manufacturing of additional types of ducting used in the aircraft field.

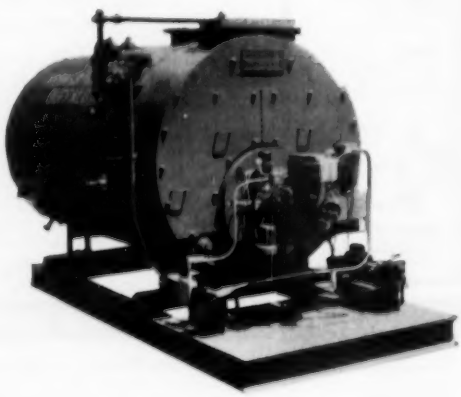
▸ *AIR REDUCTION SALES CO.* has contracted for the delivery and erection of a standardized steel building to house new equipment which will double the output of industrial gases at the plant at Butler, Pa., the company reports. The addition is expected to be in full operation late this year.

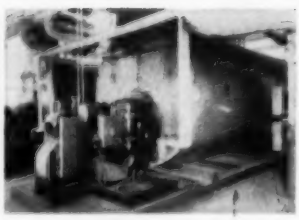
▸ *BYRON JACKSON DIV., BORG-WARNER CORP.* has announced the availability of seven scholarships to Illinois Institute of Technology. High school seniors who combine academic and technical excellence with qualities of character and leadership are eligible to apply for these scholarships, the company reports.

▸ A week long sales school and clinic, attended by over 40 sales representatives of *WILLIAM WALLACE CO.*, was held recently at the company's headquarters at Belmont, Calif.

▸ The opening in New York City of a new service annex designed to provide expanded facilities for manufacturing and packaging water treating chemicals has been announced by *WATER SERVICE LABORATORIES, INC.* The new 10,000 sq ft plant released space in the firm's main building for enlarged laboratory facilities in which an increased program of research on water corrosion is now under way.

▸ It was "back to school" for 24 members of the *McDONNELL & MILLER, INC.* sales organization





Two BISON Super Scot Low-Pressure Boilers at Sylvania Electric Products, Inc., Batavia, N. Y. Engineers and General Contractors, Siegfried Construction Co., Inc., Buffalo, N. Y.; Heating Contractors, Joseph Davis, Inc., Buffalo, N. Y.

BISON

SUPER SCOT BOILERS

for packaged heating units

To the best in the century-old Scotch Boiler with its tried-and-true two-pass design, BISON Super Scot Low-Pressure Boilers offer a number of advantages made possible by their exclusive features.

Per unit of heating surface, Super Scot Boilers are bigger. They have a larger furnace, more steam space and water content. The area directly exposed to the radiant heat of combustion is a greater percentage of the total heating surface. Certified ratings are moderate but extra loads can be handled with larger burners.

Results—smokeless combustion, extra capacity for peak loads, lower maintenance, longer life and less cost of steam generated.

Consult F & T also for high-pressure boilers.

FARRAR & TREFTS DIVISION
ADSCO INDUSTRIES, INC.
20 MILBURN ST. BUFFALO 12, N. Y.

put
Extra-Profits
in your
pocket
with

"engineer-approved"

ELGEN *All-Tite* VANE RUNNERS

NOW IN COILS!

THE EASIEST AND QUICKEST WAY EVER DEVISED
for installing single or double blade turning vanes in square elbows. No special tools required.

New production machinery of our own exclusive design, now enables us to produce button type Elgen All-Tite vane runners in continuous coils, effecting a savings in *your* cost per job.

COILED ELGEN ALL-TITE VANE RUNNERS MEANS . . .

- *Less Waste!* Waste pieces due to short ends are a thing of the past. Vane runner metal is coiled in 100 foot lengths, you just pull out the exact footage needed.
- *Easier Storage!* Each coil weighs approximately 50 lbs. and is packed in a box 28" x 28" x 5". Box fits easily under bench or against wall.
- *Easier Handling!* No loose pieces lying around to get in the way or collect dirt.
- *Unrolls absolutely flat!* Vane runner metal emerges from the box at bench height . . . absolutely flat . . . ready for use.

TWO MORE ENGINEER-APPROVED ELGEN PRODUCTS THAT SAVE YOU TIME AND MONEY

ELGEN SILENT DUCT

. . . for forming "flexible" duct connectors. A one piece metal to material unit, packed in coils, unrolls absolutely flat. Makes on the spot work a cinch.

ELGEN DAMPERSET

. . . for multi-blade dampers, parallel or opposed. Most perfect damper hardware developed.

ELGEN PRODUCTS ARE SOLD THROUGH LEADING JOBBERS EVERYWHERE.

Write today for free catalog and "spec" sheet!

ELGEN MANUFACTURING CORP.
41-34 39th Street, Long Island City 4, N. Y.

This Bulletin can help you select a better-designed Condensation Unit

ACT NOW TO GET COMPLETE DATA on these American-Marsh *Redi-Return* Condensation Units. Then judge for yourself the better engineering and quality of pump and tank . . . built for extra years of trouble-free service.

EASY-TO-INSTALL DESIGN helps you . . . only two pipe connections are needed. Motor-pump units can be removed without disturbing piping.

THE BULLETIN shows sizes from 10,000 to 100,000 sq. ft. EDR, cast iron or copper-bearing steel tanks and single or duplex motors of 1750 or 3500 RPM. Optional mounting base styles suit any installation, even crowded locations. Performance Tables and "How to Select" suggestions make this bulletin most helpful to you. *Get your copy now*

WRITE today for BULLETIN 426

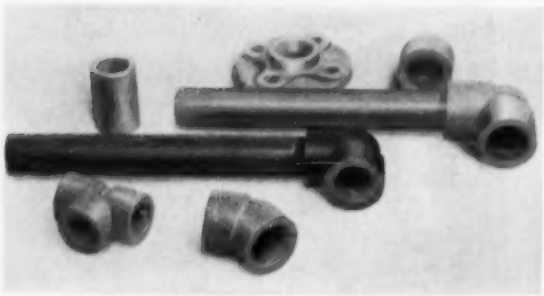
AMERICAN-MARSH PUMPS
BATTLE CREEK MICHIGAN

Pumps and Pumps only Since 1873

In Canada: American-Marsh Pumps (Canada) Ltd., Stratford, Ont.

CENTRIFUGAL, TURBINE, STEAM AND POWER PUMPS FOR TESTING, PROCESSING, BOILER FEED, FIRE PROTECTION, ETC.

new PIPING ECONOMY for handling corrosives



Carpenter PVC pipe and fittings

● Here is a new Carpenter service to help processing plants cut piping costs for handling a wide variety of corrosives under moderate operating temperature and pressure conditions. Carpenter PVC Plastic Pipe and Fittings are admirably suited for such piping requirements because of the excellent corrosion resistance, strength and other desirable properties of the unplasticized polyvinyl chloride from which they are made. They withstand both oxidizing and reducing conditions. For this reason, Carpenter PVC Pipe and Fittings supplement other corrosion-resistant piping materials previously made available by Carpenter research and production advances in stainless and specialty steels.

Two types of Carpenter PVC Pipe and Fittings are available—No. 1 provides outstanding chemical resistance along with high strength, toughness and rigidity. No. 2 provides high impact strength and excellent corrosion resistance. Both types are available in eight pipe sizes of ½" to 4". Pipe is made in Schedules 40 and 80. A full line of Schedule 80 threaded and socket fittings is available.

Easily and economically installed with usual piping tools, Carpenter PVC Pipe and Fittings assure trouble-free service with cost economy. Why not look into the advantages of using Carpenter PVC Piping systems in your plant? Consult your nearby Carpenter Distributor or Representative and ask for new Technical Bulletin T.D. 119.

MEMBER **The Carpenter Steel Company**
Alloy Tube Division, Union, N.J.

Export Dept.: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

Carpenter

PVC Pipe and Fittings

WE HEAR THAT

Continued

when they attended a five-day sales training school recently.

▶ A new volume of *Five-Minute Safety Talks for Foremen* has been published by the *NATIONAL SAFETY COUNCIL*. The talks include material on the use of powder actuated hand tools, caustic chemicals, explosive dusts, fammable liquids, drills, saws and electricity.

▶ For the third time in 11 years, *FLODAR CORP.* has had to move to larger quarters. The new plant, at 16911 St. Clair Ave., Cleveland, is said to have over seven times the floor space of the former location in that city.

▶ *WESTINGHOUSE ELECTRIC CORP.* plans to add to its new research laboratories. The addition will consist of a four-story wing to the present L-shaped building located in Churchill Borough, near Pittsburgh. The wing will contain about 150,000 sq ft of laboratory and office space. Completion is scheduled for late 1957.

▶ An expanded program of training for heating-cooling contractors will be offered in the new *INSTITUTE OF BOILER AND RADIATOR MANUFACTURERS* heating and cooling school during 1956, I=B=R announces. Four-day sessions will be held in Buffalo, Newark, Philadelphia, Boston and Ames, Ia. Most of the schedule will be devoted to practical classroom problems.

▶ A plant enlargement and modernizing program costing approximately $500,000 is being completed by *GOSHEN RUBBER CO.* Improvements include construction to increase floor space by 24,000 sq ft, additions to molding, processing and power plant equipment, and doubling of silicone product fabricating capacity, the company reports.

▶ Designed to better serve pump users in the West Coast area, a new corporation, *GOULDS PUMPS WESTERN, INC.*, Portland, Ore., has been formed. *R. W. CLARKE* is vice president and sales manager and *H. W. WINFREE*, secretary of the new organization.

▶ *ALLEGHENY LUDLUM STEEL CORP.* has completed a new induction vacuum melting department at its Watervliet, N. Y., works. The new facility is being utilized temporarily as a research and development project. It is expected to be converted to a regular production status as soon as a number of research studies now underway are completed. ≠

Swartwout *Airjector*—

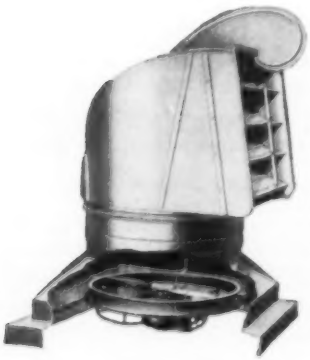
the powered rotary ventilator that gives you

TWO ventilators in ONE

Power or gravity ventilation, as the load varies

If the type of your operations or the construction of your buildings requires *power* ventilation, Swartwout Airjector gives you efficiency and economy — combined with pleasing appearance. If your operations produce extra floods of heat at certain periods but need only moderate ventilation otherwise, Airjector handles both jobs admirably. It supplies large capacity power expulsion when you need it; free gravity flow of heat and air when the capacity requirement is less.

Made in 13 throat sizes, Airjectors can be supplied in over 100 capacity variations to suit specific needs. Also available with "very quiet" fans.



Get the full story about Airjectors in our Bulletin AJ-F.

Swartwout's complete line of gravity and powered ventilators and ventilating louvers is found in Sweet's Architectural and Plant Engineering Files.

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Roof Ventilators and Ventilating Louvers

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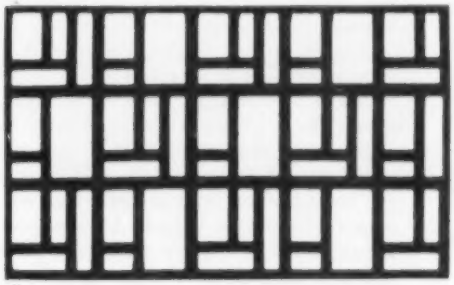
FOR EXTRA *Elegance* IN INTERIORS



Hendrick Perforated Metal Grilles will greatly enhance the beauty of your decorative motif. Both eye-appealing and functional, they provide more-than-ample area for the free passage of air. Available in a wide variety of designs, they're a cinch to install . . . always lie flat, don't bend or warp.

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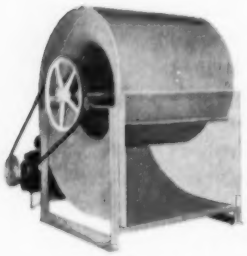
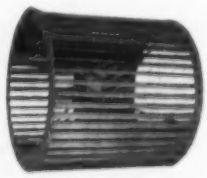


Double Inlet Blower



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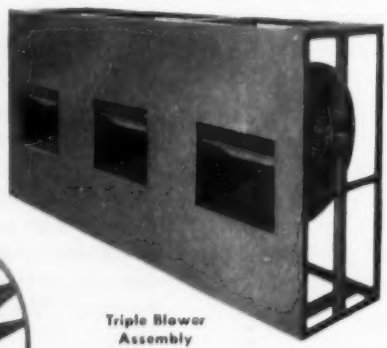
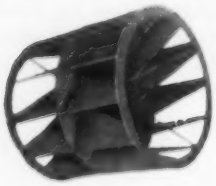
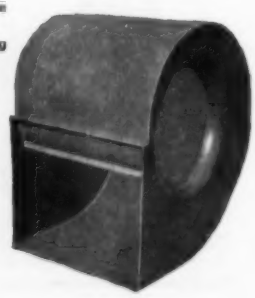


Triple Blower Assembly



Double Inlet Backwardly Curved Wheel

Double Inlet Housing



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MEETINGS & CONVENTIONS

1956

SEPT. 10-12—*American Society of Mechanical Engineers*, fall meeting. Denver. ASME headquarters: 29 W. 39th St., New York 18.

SEPT. 17-21—*11th Annual Instrument-Automation Conference and Exhibit*. Coliseum, Columbia University, and Hotels Statler and New Yorker, New York. Sponsored by Instrument Society of America, 313 Sixth Ave., Pittsburgh 22.

SEPT. 17-21—*American Society for Testing Materials*, second Pacific area national meeting. Hotel Statler, Los Angeles. ASTM headquarters: 1916 Race St., Philadelphia 3.

SEPT. 20-21—*National Association of Corrosion Engineers*, sixth annual corrosion control short course. Centenary College, Shreveport, La. Sponsored by Shreveport section, NACE. Information: Bob Naremore, Arkansas Fuel Oil Corp., P. O. Box 11117, Shreveport, La.

SEPT. 24-28—*Trade Fair of the Atomic Industry*. Navy Pier, Chicago. Conference headquarters is Morrison Hotel, Chicago. Information: D. J. Scherer, Atomic Industrial Forum, Inc., 260 Madison Ave., New York 16.

SEPT. 25-26—*Producers' Council, Inc.*, 35th annual fall meeting and chapter presidents' conference. Wade Park Manor Hotel, Cleveland. Information: Producers' Council, Inc., 2029 K St., N.W., Washington 6, D.C.

SEPT. 25-27—*Third Annual Forum Conference*, "Management and Technology for the Atomic Industry." Morrison Hotel, Chicago. Information: D. J. Scherer, Atomic Industrial Forum, Inc., 260 Madison Ave., New York 16.

OCT. 1-3—*Mechanical Contractors Association of America*, fall board of directors meeting and secretaries' conference. Hotel Statler, Detroit. Headquarters: 30 Rockefeller Plaza, New York 20.

OCT. 1-3—*12th Annual National Electronics Conference*. Hotel Sherman, Chicago. Information: J. S. Powers, executive secretary, National Electronics Conference, 84 E. Randolph St., Chicago 1.

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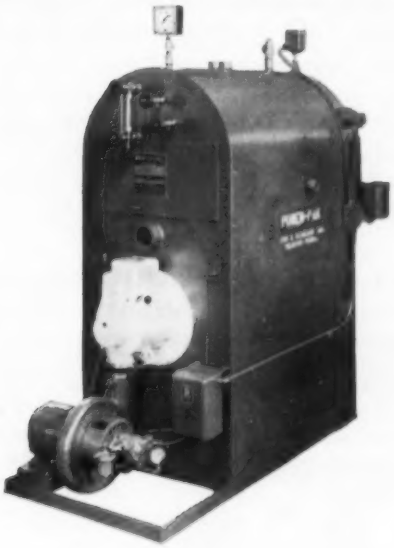

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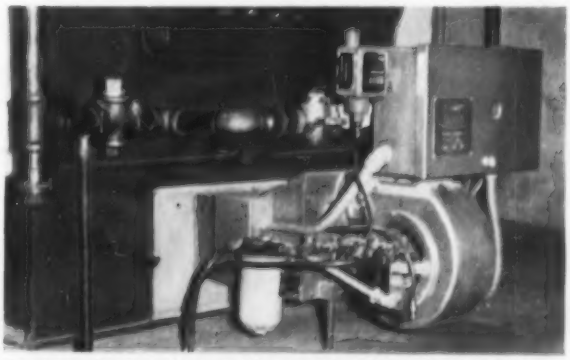
- **No coking or clogging of oil nozzle.** Shield protects oil manifold against reflected heat. Air cooled during gas cycle.



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MEETINGS & CONVENTIONS *Continued*

1956

OCT. 8-12—*American Welding Society*, fall technical meeting. Hotel Cleveland, Cleveland. Headquarters: 33 W. 39th St., New York 18.

OCT. 15-17—*American Gas Association*, annual convention. Atlantic City. AGA headquarters: 420 Lexington Ave., New York 17.

OCT. 15-17—*National Association of Corrosion Engineers*, northeast regional meeting. Drake Hotel, Philadelphia. NACE headquarters: 1061 M & M Bldg., Houston 2.

OCT. 22-24—*American Standards Association*, 38th annual meeting, in conjunction with Seventh National Conference on Standards. Hotel Roosevelt, New York. Headquarters: 70 E. 45th St., New York.

OCT. 22-26—*44th National Safety Congress & Exposition*. Chicago. National Safety Council, 425 N. Michigan Ave., Chicago 11.

OCT. 23-26—*National Association of Corrosion Engineers*, south central regional meeting. Gunter Hotel, San Antonio. NACE headquarters: 1061 M&M Bldg., Houston 2.

OCT. 24-27—*Air-Conditioning and Refrigeration Wholesalers*, annual meeting. Jung Hotel, New Orleans. Headquarters: 2607 N. High St., Columbus, Ohio.

OCT. 29-*NOV.* 2—*National Association of Practical Refrigerating Engineers, Inc.*, annual convention. Statler Hotel, Detroit. Headquarters: 435 N. Waller Ave., Chicago 44.

NOV. 8-9—*National Association of Corrosion Engineers*, southeast regional meeting. Charlotte, N. C. NACE headquarters: 1061 M & M Bldg., Houston 2.

NOV. 15-16—*National Association of Corrosion Engineers*, north central regional meeting. Hotel Statler, Detroit. NACE headquarters: 1061 M&M Bldg., Houston 2.

NOV. 15-18—*Refrigeration Service Engineers Society*, annual convention. Hotel Muehlbach, Kansas City, Mo. Headquarters: 433 N. Waller Ave., Chicago.

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The Silencing System That Quiets Air-Conditioning and Ventilating Systems

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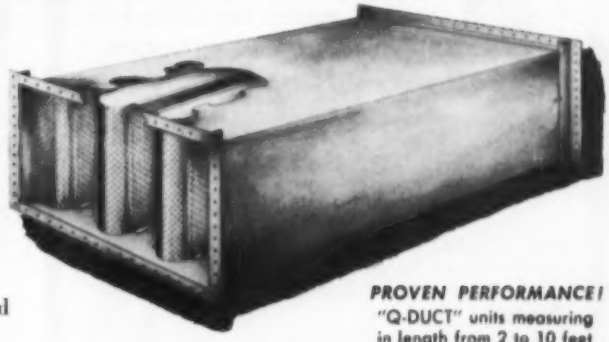

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MEETINGS & CONVENTIONS — *Continued*

1956

NOV. 25-28—*American Society of Refrigerating Engineers*, semi-annual meeting. Hotel Statler, Boston. Information: ASRE, 234 Fifth Ave., New York 1.

NOV. 25-30—*American Society of Mechanical Engineers*, annual meeting. Statler Hotel, New York. ASME headquarters: 29 W. 39th St., New York 1.

NOV. 26-28—*Refrigeration and Air Conditioning Contractors Association*, annual convention. Balmoral Hotel, Miami Beach. RACCA headquarters: 10660 Carnegie Avenue, Cleveland 6.

NOV. 26-30—*22nd National Exposition of Power and Mechanical Engineering*. Coliseum, New York. Under auspices of American Society of Mechanical Engineers. Manager: E. K. Stevens, care of the Exposition, 480 Lexington Ave., New York 17.

NOV. 26-30—*Third International Automation Exposition*. Trade Show Bldg., New York. Management:

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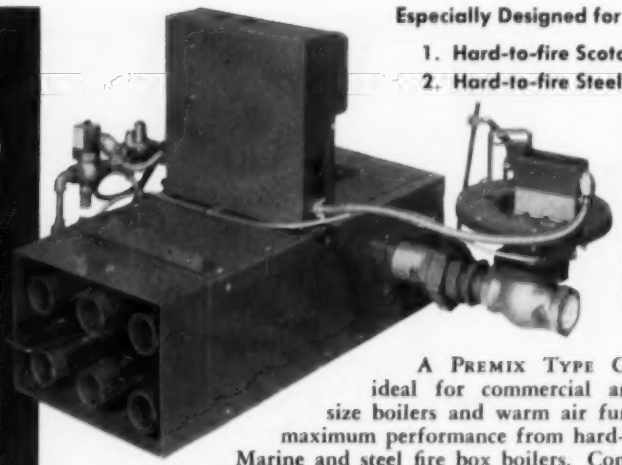

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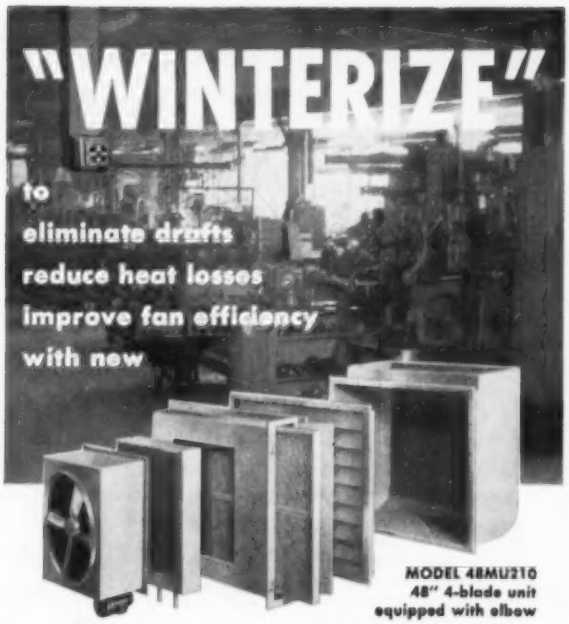

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48" 4-blade unit
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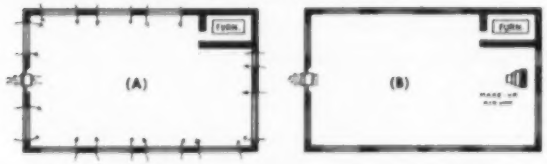

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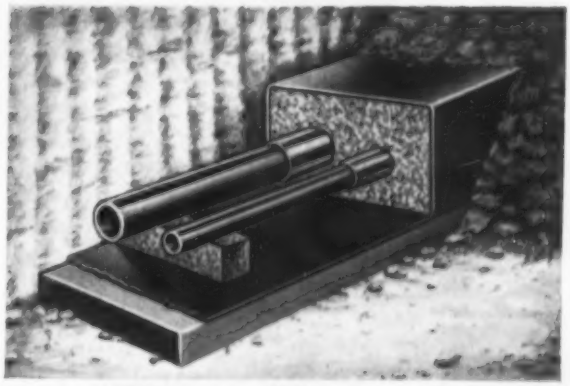

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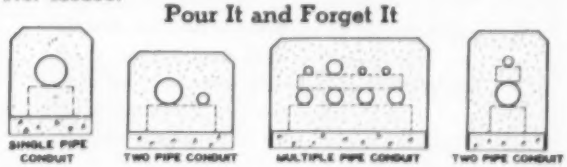

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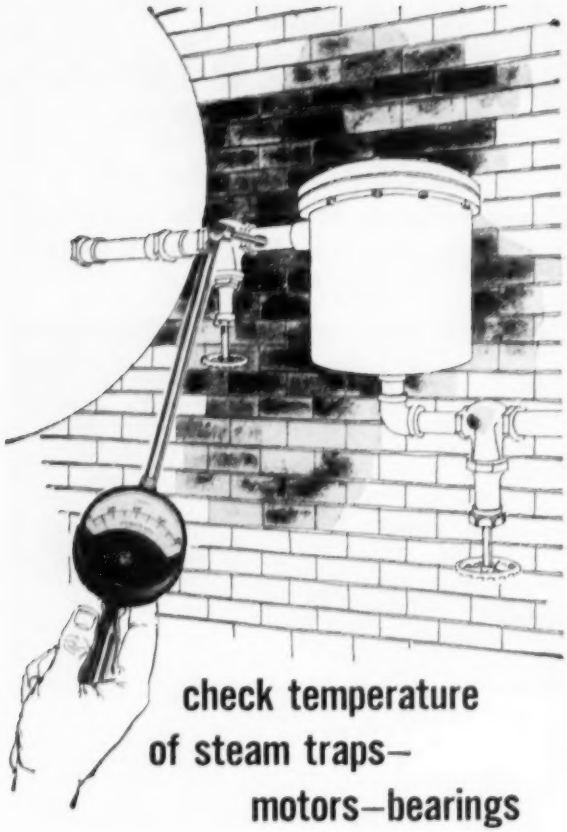

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MEETINGS & CONVENTIONS *Continued*

1956

Richard Rimbach Assoc., Inc., 845 Ridge Ave., Pittsburgh 12.

NOV. 26-30—*National Warm Air Heating and Air Conditioning Association*, committee meetings and annual convention. Netherland Plaza, Cincinnati. NWAHACA headquarters: 640 Engineers Bldg., Cleveland.

NOV. 27-30—*Ninth National Chemical Exposition*. Public Auditorium, Cleveland. Chicago Section of the American Chemical Society, 86 E. Randolph St., Chicago 1.

1957

JAN. 28-31—*Eighth National Plant Maintenance & Engineering Show*. Public Auditorium, Cleveland. Information: Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

FEB. 4-8—*American Society for Testing Materials*, committee week. Benjamin Franklin Hotel, Philadelphia. ASTM headquarters: 1916 Race St., Philadelphia 3.

FEB. 8-10—*Air Conditioning, Ventilating and Electric Space Heating Exposition*. Sheraton Park Hotel, Washington, D.C. Conducted by the Electric Institute of Washington, 10th and E Sts., N.W., Washington 1, D.C.

FEB. 18-21—*Sixth Annual Industrial Ventilation Conference*. Kellogg Center, Michigan State University. Information: Industrial Ventilation Conference, Continuing Education Service, Michigan State University, East Lansing, Mich.

FEB. 25-28—*American Society of Heating and Air-Conditioning Engineers, Inc.*, 63rd annual meeting. Conrad Hilton Hotel, Chicago. Information: A. V. Hutchinson, executive secretary, ASHAE, 62 Worth St., New York 13.

FEB. 25-*MARCH* 1—*13th International Heating and Air-Conditioning Exposition*. International Amphitheater, Chicago. Under management of International

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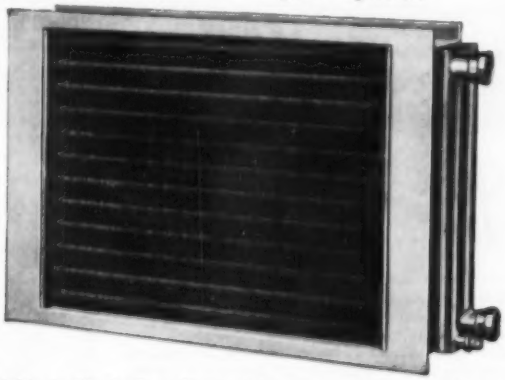
For Use In Combination With Air Conditioning Coils Or As Tempering and Booster Units in Long Heating Ducts.



Available in Single Row Type with BTU per hour capacity from 60,000 to 360,000. In Double Row Type, for heavy duty service, in capacities from 129,000 to 775,000 BTU per hour. Heavy gauge steel casings. Copper tubes and headers. Tested 350 lbs. air pressure for steam working pressures up to 125 lbs. Defroster-standard equipment. Also suitable for hot water.

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Dual discharge openings for optional piping connection to boiler.

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Rectangular receiver provides maximum capacity with minimum space.

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MEETINGS & CONVENTIONS — *Continued*

1957

Heating and Air-Conditioning Exposition Co., 480 Lexington Ave., New York 17.

MARCH 11-15—*National Association of Corrosion Engineers*, annual conference and exhibition. Kiel Auditorium, St. Louis. NACE headquarters: 1061 M&M Bldg., Houston 2.

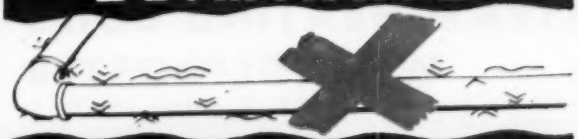
APRIL 14-17—*Building Research Institute*, annual meeting. Edgewater Beach Hotel, Chicago. BRI headquarters: 2101 Constitution Ave., Washington 25, D.C.

APR. 14-27—*United States World Trade Fair*. Coliseum, New York. Information: United States World Trade Fair, 331 Madison Ave., New York.

MAY 6-8—*Air-Conditioning and Refrigeration Institute*, annual meeting. The Homestead, Hot Springs, Va. ARI headquarters: 1346 Connecticut Ave., N.W., Washington 6, D.C.

MAY 7-10—*Mechanical Contractors Association of America*, annual meeting. Hotel Fontainebleau, Miami

ELIMINATE



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Model BD-43 is only 41½" high, delivers up to 16,500 cfm

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DUX-SULATION
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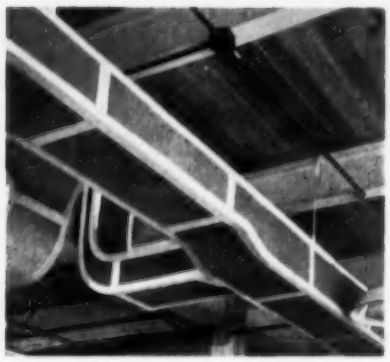

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MEETINGS & CONVENTIONS — *Continued*

1957

Beach. The association is at 30 Rockefeller Plaza, New York 20.

MAY 20-24—*National Fire Protection Association*, annual meeting. Hotel Statler, Los Angeles. NFPA headquarters: 60 Batterymarch St., Boston.

JUNE 2-5—*American Society of Refrigerating Engineers*, annual meeting. Hotel Fontainebleau, Miami Beach. ASRE headquarters: 234 Fifth Ave., New York.

JUNE 16-21—*American Society for Testing Materials*. Chalfonte-Haddon Hall, Atlantic City. ASTM headquarters: 1916 Race St., Philadelphia 3.

JUNE 24-27—*American Society of Heating and Air-Conditioning Engineers, Inc.*, semi-annual meeting. Murray Bay, Quebec. Information: A. V. Hutchinson, executive secretary, ASHAE, 62 Worth St., New York 13.

AUG. 11-15—*First National Conference on Applied Heat Transfer*. Pennsylvania State University, University Park, Pa. Sponsored by heat transfer division and central Pennsylvania section of American Society of Mechanical Engineers in cooperation with College of Engineering and Architecture of the University. ASME headquarters: 29 W. 39th St., New York 18.

OCT. 7-9—*American Gas Association*, annual convention. Kiel Auditorium, St. Louis. AGA headquarters: 420 Lexington Ave., New York 17.

OCT. 21-25—*45th National Safety Congress & Exposition*. Chicago. National Safety Council, 425 N. Michigan Ave., Chicago 11.

NOV. 14-16—*American Society of Refrigerating Engineers*, semi-annual meeting. Morrison Hotel, Chicago. ASRE headquarters: 234 Fifth Ave., New York.

NOV. 18-21—*10th Exposition of the Air-Conditioning and Refrigeration Industry*. Navy Pier, Chicago. Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N.W., Washington 6, D.C.

NOV. 18-22—*National Warm Air Heating and Air Conditioning Association*, committee meetings and annual convention. Morrison Hotel, Chicago. NWAHACA headquarters: 640 Engineers Building, Cleveland 14.

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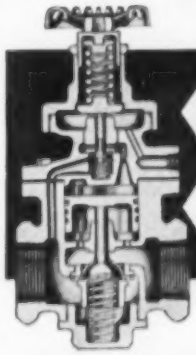

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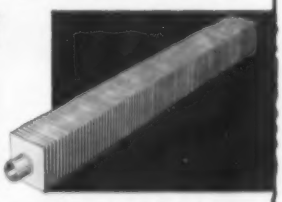

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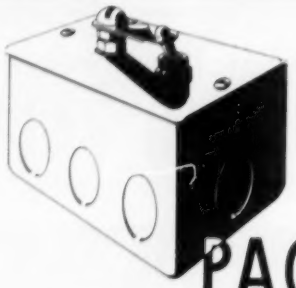

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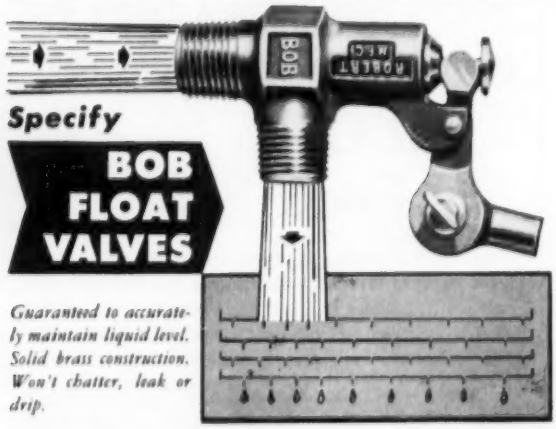

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NEW BOOKS & REPORTS...

MECHANICAL ENGINEERING PRACTICE—Fifth Ed. By Charles F. Shoop and George L. Tuve. 471 pp. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36. $7.00.

THE MECHANICAL PROPERTIES OF WROUGHT PHOSPHOR BRONZE ALLOYS—ASTM special technical publication No. 183. 120 pp. American Society for Testing Materials, 1916 Race St., Philadelphia 3. $3.00.

1952-1953 BIBLIOGRAPHIC SURVEY OF CORROSION—NACE publication No. 56-11. 382 pp. National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2. $12.50.

ASTM PROCEEDINGS—1955 Ed. 1264 pp. American Society for Testing Materials, 1916 Race St., Philadelphia 3. $12.00.

IMPORTANCE OF BIOLOGICAL RESEARCH IN INDUSTRIAL MEDICINE—By Paul Gross, Helmuth H. Schrenk and C. Richard Walmer. 12 pp. Industrial Hygiene Foundation, Mellon Institute, 4400 Fifth Ave., Pittsburgh 13. Free.

ASTM STANDARDS ON COPPER AND COPPER ALLOYS—Sponsored by ASTM committee on copper and copper alloys, cast and wrought. 654 pp. American Society for Testing Materials, 1916 Race St., Philadelphia 3. $5.75.

RIGID POLYVINYL CHLORIDE SHEETS—Commercial standard CS201-55. 12 pp. U. S. Government Printing Office, Washington 25, D.C. 10c.

RECOMMENDED BOILER ROOM PLANS FOR COAL BURNING—Market Promotion Department, National Coal Association, Southern Bldg., Washington 5, D.C. Free.

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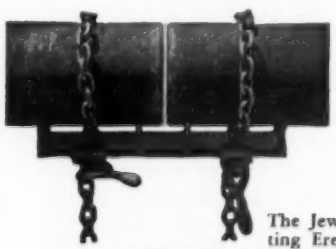

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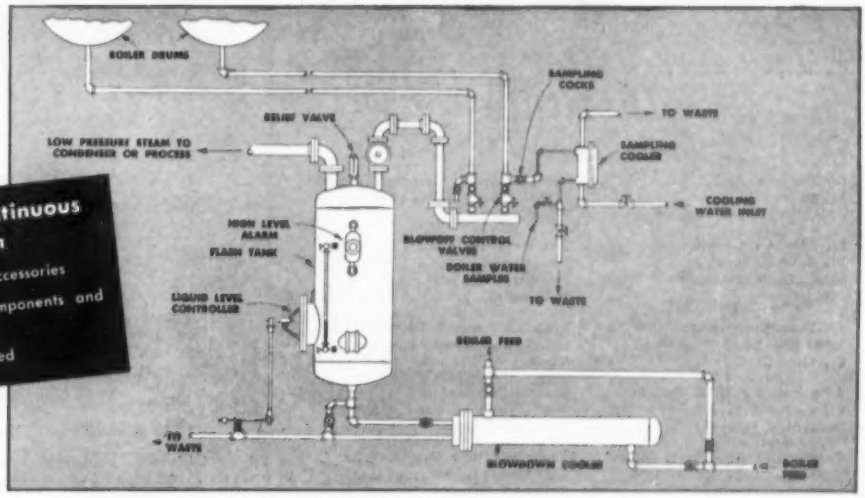

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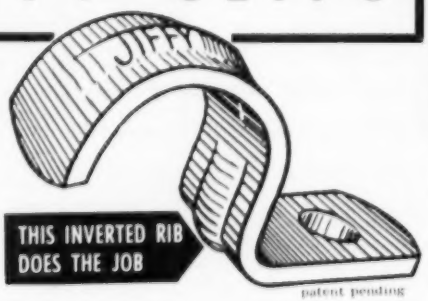

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AMERICAN STANDARDS—Price list and index, spring 1956. 56 pp. American Standards Association, 70 E. 45th St., New York 17. Free.

CONTRACTORS' PUMP MANUAL—Contractors' Pump Bureau, Associated General Contractors of America, 1227 Mensey Bldg., Washington 4, D.C. $1.00.

PANEL DISCUSSION ON PYROMETRIC PRACTICES—ASTM special technical publication No. 178. 52 pp. American Society for Testing Materials, 1916 Race St., Philadelphia 3. $1.50.

SYMPOSIUM ON ATMOSPHERIC CORROSION OF NON-FERROUS METALS—ASTM special technical publication No. 175. 164 pp. American Society for Testing Materials, 1916 Race St., Philadelphia 3. $2.75.

ENGINEERING FORMULAS & TABLES—350 pp. Lefax Publishers, Philadelphia 7. $2.75. ⧺

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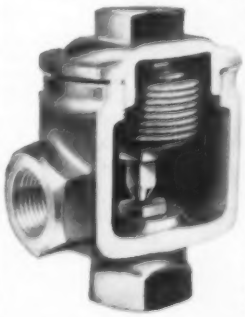

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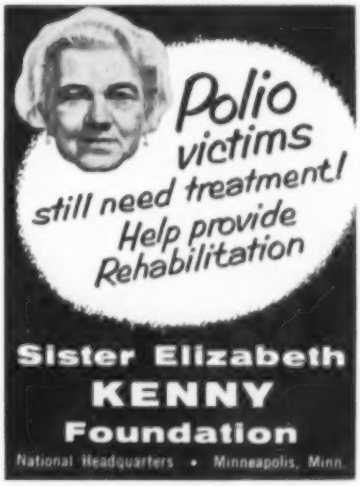

INDEX TO ADVERTISERS

Firms represented in this issue are identified by the folio of the page on which their advertising appears. Advertising which appears in other issues is marked with an asterisk.

A-J Mfg. Co. 285
Acme Industries, Inc. 166, 167
Aerofin Corp. *
Aerovent Fan Co., Inc. 303
Air Control Products, Inc. 160
Air Devices, Inc. 272
Air Distribution Products 179
Air-Factors, Inc. *
Air Filter Institute 312
Air-Maze Corp. 277
Air & Refrigeration Corp. *
Airtemp Div., Chrysler Corp. 161
Airtherm Mfg. Co. 209
Aladdin Heating Corp. 193
Alco Valve Co. 51
Allen-Bradley Co. *
Allen Cooler & Ventilator Inc. 205
Allis-Chalmers Mfg. Co. 162
Allis Co., Louis 243
Alter Co., The Harry 305
American Air Filter Co., Inc. 56, 168, 169
American Blower Corp. 59
American Brass Co., The 195
American Dist. Steam Div., Adsco Industries, Inc. 266
American Gilsonite Co. 227
American-Marsh Pumps, Inc. 295
American Metal Hose Branch American Brass Co., The 195
American Radiator & Standard Sanitary Corp., Plumbing & Heating Div. 164, 165
Ames Iron Works *
Ammerman Co., C. L. 314
Anderson Co., V. D., Div. of International Basic Economy Corp. *
Anemostat Corp. of America *
Armstrong Cork Co. 26
Armstrong Machine Works 6
Aurora Pump Co. 306

Babbitt Steam Specialty Co. 254
Babcock & Wilcox Co., Boiler Div. 64
Babcock & Wilcox Co., Tubular Prod. Div. *
Babcock & Wilcox Co., Tubular Product Div. Fittings Dept. *
Badger Manufacturing Co. 45
Barber-Colman Co. 150
Bacharach Industrial Instrument Co. *
Barneby-Cheney Co. 220
Barry Blower Co. 298
Bayley Blower Co. *
Bell & Gossett Co. 48
Bethlehem Steel Company 62
B-I-F Industries Inc. *
Binks Mfg. Co. *
Bishop & Babcock Mfg. Co. 199
Boiler Engineering & Supply Co., Inc. 241
Bonney Forge & Tool Works *
Brundage Co., The 247
Bruner Corp., The *
Brunner Mfg. Co. 192
Buensod-Stacey, Inc. 229
Buffalo Forge Co. 8, 9
Buffalo Pumps, Inc., Div. of Buffalo Forge Co. 250
Burnham Corporation 233
Byers Co., A. M. *

Cambridge Filter Corp. 279
Campbell Heating Co. 237
Cam-Stat Inc. *
Capitol Mfg. & Supply Co. 260
Carey Elec. Engr. Co. *
Carrier Corp. 20, 70, 71, 196
Carpenter & Paterson, Inc. 289
Carpenter Steel Co., The 296
Carver Pump Co. 180
Cash Co., A. W. *
Century Electric Co. 41
Chase Brass & Copper Co. 32, 33
Chesapeake and Ohio Railway *
Chicago Blower Corp. *
Chicago Pump Co. 158
Clarage Fan Co. Inside Back Cover
Cleaver-Brooks Co., Boiler Div. *
Cleaver-Brooks Co., Burner Div. 57
Cleveland Fuel Equipment Co. 254
Combustion Control Div., Electronics Corp. of America *
Combustion Eng., Inc. 235
Committee on Steel Pipe Research American Iron & Steel Institute 245
Connor Engineering Corp. 268
Continental Air Filters, Inc. *
Cook Co., Loren 307
Cornish Rutland Co. *
Crane Co. 35, 36
Crane Packing Company 307
Curtis Refrigeration Machine Div. of Curtis Mfg. Co. *
Cyclotherm Division National-U. S. Radiator Corp. *

Davis Eng. Corp. 236
De Bothezat Fans Division, American Machine & Metals, Inc. 187
DeLaval Steam Turbine Co. 212
Delta Heating Co. *
Deming Co., The 248
Detroit Controls Corp. *
Diamond Mfg. Co. 312
Diehl Mfg. Co., Inc. *
Dodge Mfg. Co. 249
Dorrr Electric Corp. *
Dollinger Corp. 251
Dover Mfg. Co. *
Dravo Corp. 253
Drayer-Hanson, Div. of National-U. S. Radiator Corp. 274
Dresser Mfg. Division *
Dunham-Bush, Inc. 4
du Pont de Nemours & Co., E. I. 264
Durant Insulated Pipe 191
Duriron Co., Inc., The 255
Duro-Dyne Corp. 314

Eagan Co., Inc., Walter H. 270
Eastern Industries, Inc. *
Economy Pumps, Inc., Div. of C. H. Wheeler Mfg. Co. 264
Electro-Air Cleaner Co. 252
Electro-Dynamic Div. of General Dynamics Corp. *
Elgen Mfg. Corp. 295
Embassy Steel Products 307
Evans Corp., The George *
Everlasting Valve Co. *

Farrar & Trefts Div., Adsco Industries, Inc. 294
Farr Co. 7
Fedders-Quigan Corp. *
Fee & Mason Mfg. Co., Inc. *
Field Control Div., H. D. Conkey & Co. *
Finn & Co., Inc., T. R. 246
Finnigan Co., J. J. *
Fisher Governor Co. 163
Fitzgibbons Boiler Co., The 244
Flexaust Company *
Flexible Tubing Corp. 211
Flexonics Corp. *
Frick Co. 50
Fulton Sylphon Div., Robertshaw-Fulton Controls Co. 177
Furnas Electric Co. 286

G. & O. Mfg. Co., The 309
Gallaher Co., The *
Garlock Packing Co., The *
General Chemical Division, Allied Chemical & Dye Corp. *
General Controls Co. 18, 19
General Electric Co. 314
General Fittings Co. 239
Golden-Anderson Valve Specialty Co. 252
Goodall Rubber Co. 287
Goodrich, B. F., Chemical Co. 257
Goodrich, B. F., Sponge Products Div. *
Gordon & Piatt, Inc. *
Goulds Pumps, Inc. 291
Govermair Corp. *
Greenlee Tool Co. 292
Grinnell Co., Inc. Inside Front Cover
Gustin-Bacon Mfg. Co. 55

Halstead & Mitchell *
Handy & Harman 225
Hart & Cooley Mfg. Co. *
Hayes Furnace Mfg. & Supply Co. 207
Heating & Air Conditioning Exposition *
Heat-X, Inc. *
Hendrick Mfg. Co. 297
Hoffman Specialty Mfg. Corp. 188
Howell Electric Motors Co. 283
Hussey & Co., C. G. *

Ilg Electric Ventilating Co. 152
Illinois Engineering Co., Div. of American Air Filter Co. 56, 168, 169
Illinois Testing Laboratories 304
Independent Register Co., The 206
Industrial Acoustics Co., Inc. 301
Industrial Plastic Fabricators *
Infra Insulation, Inc. 185
Ingersoll-Rand Co. *
Insto-Gas Corp. *
International Boiler Works Co., The *
International Mfg. Co. 290
Iron Fireman Mfg. Co., SelecTemp Division 29

Jackes Evans Mfg. Co. 210
Janitrol Heating & Air Conditioning Div., Surface Combustion Corp. 60, 61
Jenkins Bros., Inc. 182
Jenn-Air Co., Inc. *
Jewel Mfg. Co., Inc. 310
Johns-Manville 149
Johnson Co., S. T. 276
Johnson Service Co. Outside Back Cover
Jones & Laughlin Steel Corp. *
Josam Mfg. Co. 306
Joy Mfg. Co. 30

Keasbey & Mattison Co. *
Kennard Corp. *
Kennedy Valve Mfg. Co. 240
Kewanee-Ross Corp. 259
Kieley & Mueller, Inc. 309
Kinetic Chemicals Div., du Pont De Nemours & Co., Inc., E. I. 261
Koppers Co., Inc., Industrial Sound Control Dept. 24, 25
Korfund Co., Inc., The *
Kramer Trenton Co. *
Kritzer Radiant Coils, Inc. 34
Kunkle Valve Co. 302

Ladish Co. *
Lau Blower Co. 203
Leslie Company *
Lewin-Mathes Company *
L. O. F. Glass Fibers Co. 263
Lima Electric Motor Co. *
Lunkenheimer Co., The 31

Maid-O'-Mist, Inc. *
Mammoth Furnace Company 284
Marathon Electric Mfg. Corp. *
Marley Co., The *
Marlo Coil Co. 265
Marsh Heating Equipment Co. 267
Marvel Engineering Co. *
McDonald Mfg. Co., A. Y. 197
McDonnell & Miller, Inc. 27
McQuay, Inc. 189
Mercoid Corp., The 258
Meriam Instruments Co., The 287
Mid-Continent Metal Prod. Co. 299
Midwest Piping Company, Inc. 159
Miller Valve Co., Inc. 278
Minerallac Electric Co. 312
Minneapolis-Honeywell Regulator Co. 14, 15, 176
Modine Mfg. Co. 170
Monarch Mfg. Works, Inc. 305
Morrison Products, Inc. 178
Mt. Hawley Mfg. Co. *
Mueller Climatrol Div. of Worthington Corp. *
Multi-Vent Div., Pyle-National Co., The 42, 43
Murray Mfg. Co., D. J. *
Myers & Bro., F. E. *

Nash Eng. Co., The 74
National Coal Association *
National Heater Co., The 293
National Tube Div., United States Steel Corp. 275
National-U. S. Radiator Corp. *
Nelson, Herman Div. of American Air Filter Co., Inc. 56, 168, 169
Nesbitt, Inc., J. J. 68, 156, 218
New York Blower Co. *
Niagara Blower Co., The 289
Norman Products Co. 223
North Amer. Mogul Products Co., The 313
Novelty Steam Boiler Works, Inc. *

Ohio Brass Co. 21
Ohio Injector Co., The 40
Olson & Company, Arthur A. *
Omark Industries 238
Orr & Sembower, Inc. 299

Packless Metal Hose Inc. 242
Palmer Thermometers, Inc. 256
Paragon Electric Co. 291
Parish Co., The 310
Patterson-Kelley Co., Inc., The *
Peerless Electric Co., The 54
Peerless of America, Inc. *
Pennsylvania Salt Mfg. Co. *
Penn Ventilator Co. 300
Petrometer Corp. 234
Petro *
Philadelphia Gear Works, Inc. *
Phillips Cooling Tower Co., Inc. 256
Pittsburgh Plate Glass Co., The Fiber Glass Division 46
Porter & Co., H. W. 281
Powell Valves 269
Powers Regulator Co. 10, 11
Prat-Daniel Corp. 305
Preferred Utilities Mfg. Corp. 232
Pritchard Co. of Calif., J. F. 216, 217

Quickdraft Company 174

R-P & C Valve Division, American Chain & Cable Co., The 214
Ramset Fastening System Winchester-Western Div., Olin Mathieson Chemical Corp. 230
Randall Graphite Bearing, Inc. *
Ray Oil Burner Co. 194
Raypak Co., Inc. 217
Reading Tube Corp. 28
Reed Mfg. Co. 202
Reflectal Corp. *
Reliance Electric & Eng. Co. 151
Remington Arms Co. *
Rempe Co. 305
Republic Steel Corp. *
Revere Copper & Brass, Inc. 16, 17
Reznor Mfg. Co. 228
Richmond Engineering Co., The 173
Ric-wil, Inc. 271
Ridge Tool Co., The 12
Rigidbilt, Inc. *
Robert Mfg. Co. 310
Roberts-Gordon Appliance Corp. 302
Robvon Backing Ring Co. 301
Rotherm Engineering Co. *

Sarco Co., Inc. *
Sarcotherm Controls, Inc. 219
SelecTemp Div., Iron Fireman Co. *
Shaw-Perkins Mfg. Co. 262
Siemon-Mfg. Co. 293
Skidmore Corp. 22
Skil Corp. *
Slant-Fin Radiator Corp. 213
Smith Co., Inc., H. B., The *
Spang-Chalfant Div. of The National Supply Co. 155
Spence Eng., Inc. *
Spencer Heater, Avco Mfg. Corp. *
Spencer Thermostat Div., Metals & Controls Corp. 172
Sporlan Valve Co. 58
Spraying Systems Co. 309
Standard Stamping & Perforating Co. *
Stephens-Adamson Mfg. Co. 153
Sterling Engrg. & Mfg. Corp. 313
Sterling, Inc. *
Stillwater Clay Products Co., The *
Stoddard Industries, Inc. 307
Superior Combustion Industries, Inc. 280
Surface Combustion Corp. 60, 61
Swartwout Co., The 297
Synchronous Flame Inc. 258

Taco Heaters, Inc. 208
Tapecoat Company, The 260
Taylor Forge & Pipe Works 52, 53
Taylor Instrument Cos. 285
Thermotank Inc., Products Div. 44
Titus Mfg. Corp. 47
Titusville Iron Works Co. The Div. of Struthers Wells Corp. 49
Torrington Mfg. Co. *
Trane Co., The *
Tube Turns, Inc. *
Tuthill Pump Co. *
Tuttle & Bailey, Div. of Allied Thermal Corp. 37, 38, 39

Union Malleable Mfg. Co. *
Unistrut Products Co. 273
United Cork Companies 204
United States Air Conditioning Corp. 3
United States Gauge Div., American Machine & Metals, Inc. 222
United States Rubber Co. 175
United States Steel Corp. 275
United Wire & Supply Corp. 200
Universal Diffuser Corp. 288
Utility Appliance Corp. *
Utility Fan Corp. 63

Van Dorn Iron Works Co. *
Vapor Heating Corp. 262
Vilter Mfg. Co., The *

Wagner Electric Corp. 23
Waldron Corp., John 180
Walker Mfg. & Sales Corp. *
Walworth Co. 157
Waterloo Register Co. *
Watson-Stillman Fittings Div., H. K. Porter Co., Inc. 198
Webster & Co. Warren 67
Webster Engineering Co., The 282
Weil-MacLain Co. 221
Weil Pump Co. 224
Weinman Pump Mfg. Co. *
Weirton Steel Co. 181
Western Eng. & Mfg. Co. *
Westinghouse Elect. Corp., Sturtevant Div. 226
Wheatland Tube Co. 215
Wheelco Instruments Div., Barber-Colman Co. 190
Wheeler Mfg. Co., C. H. 264
Wheeling Corrugating Co. *
Wheeling Steel Corp. 201
White-Rodgers Co. *
Whitlock Mfg. Co., The 311
Will-Burt Company, The 231
Wilson Engineering Corp. *
Wilson Inc., Grant 308
Wing Mfg. Co., L. J. 73
Wiremold Co., The *
W-K-M Manufacturing Co., Inc. 309
Wolverine Tube Div. of Calumet & Hecla, Inc. 171
Worthington Corp. 154

Yarnall-Waring Co. *
York Corporation *
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Young Radiator Co. *
Youngstown Sheet & Tube Co. 13

Zallea Bros. *
Zonolite Company 303

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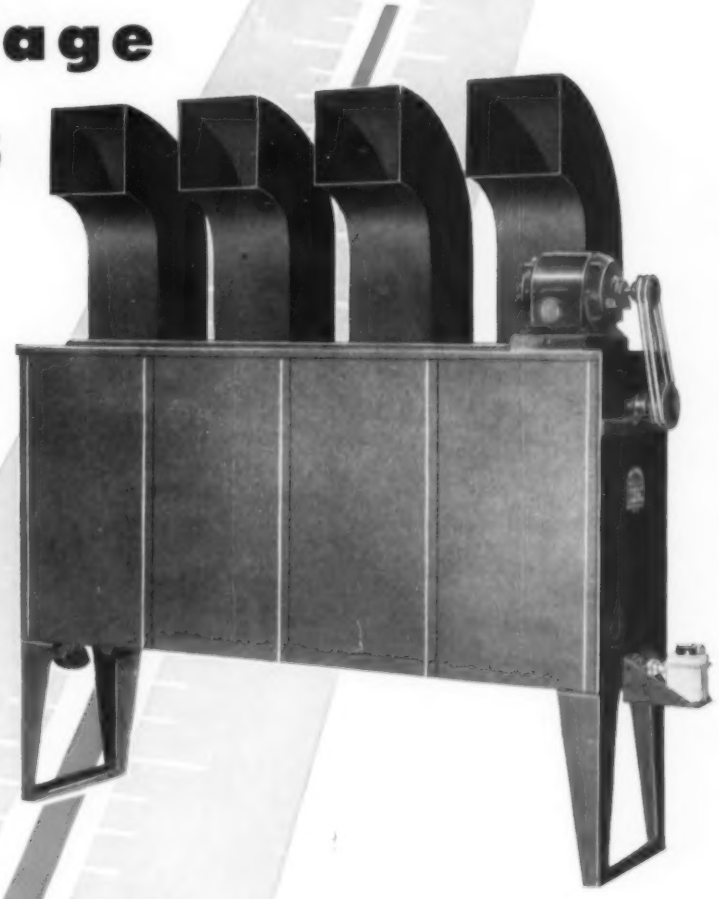

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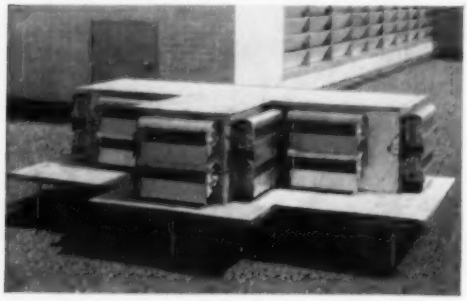
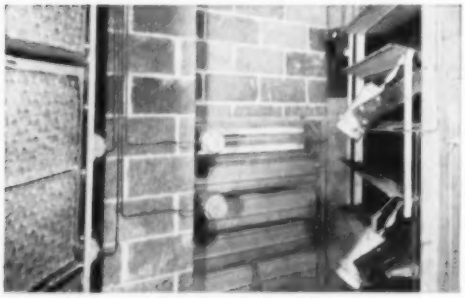
• for Economy



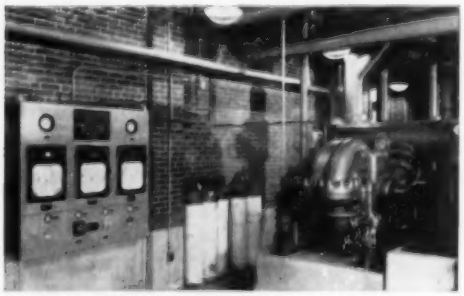
From a rooftop model, 16 Master Zone Thermostats anticipate the need for more or less heating or cooling by measuring the combined effect of outdoor temperatures and solar heat gain on perimeter sections of the building.

Liberty Life Insurance Company, Greenville, S. C. Lockwood Greene Engineers, Inc., architects and mechanical engineers, New York and Spartanburg, S. C.; Buensod-Stacey, Inc., air conditioning contractor, Charlotte, N. C.

• JOHNSON Air Conditioning CONTROL



Primary air for air conditioning is an economical mixture of outdoor air and return air. Mixture is properly proportioned and accurately controlled by Johnson Thermostats, Damper Operators and Dampers in chambers such as this.



Refrigeration control panel is mounted in the main machine room. Johnson Record-O-Stats provide a convenient written record of water temperatures and make it easy to check on operating efficiency.

How can you be *sure* an air conditioning system will produce the kind of satisfying, year 'round comfort the owners and occupants expect of it? Equally important, how can you make certain of *waste-free* heating and cooling operation?

In thousands of the nation's leading buildings, with these very same problems, the simple, successful answer is Johnson Air Conditioning Control.

For example, that's the kind of performance Liberty Mutual demands, *and gets*, in its modern new building shown here. With Johnson Control in command of the air conditioning system, ideal temperatures prevail constantly. Operation is completely automatic. It's the modern worry-free, trouble-free, waste-free way to realize the *full* benefits of an investment in air conditioning.

Whether your problems involve air conditioning for a new building or for an existing building . . . whether it's single-story or multi-story . . . take advantage of the unmatched comfort and economy features of a Johnson-engineered Control System. A nearby Johnson engineer will gladly make recommendations at your convenience. No obligation, of course. Johnson Service Company, Milwaukee 1, Wisconsin. Direct Branch Offices in Principal Cities.

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